The UNESCO Courier

A window open on the world

August-September 1969 (22nd year) - Price : $1.50

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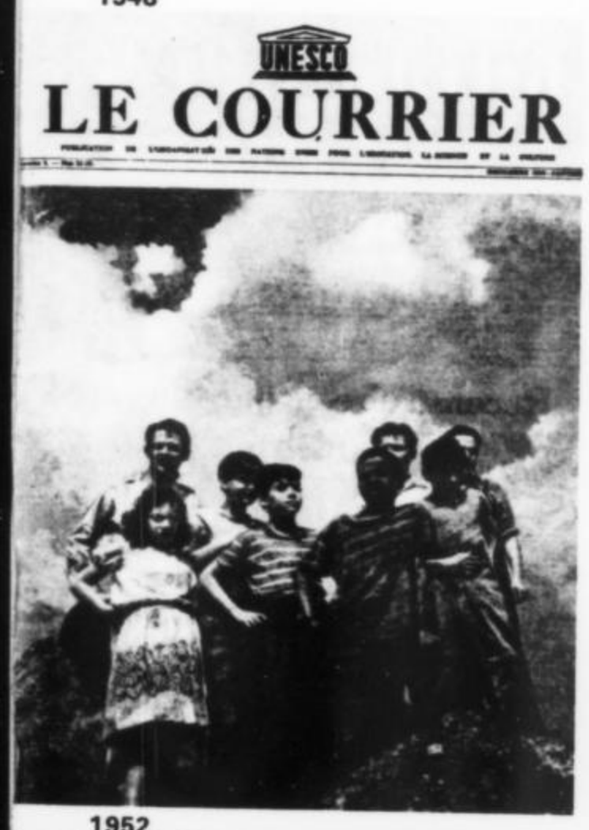

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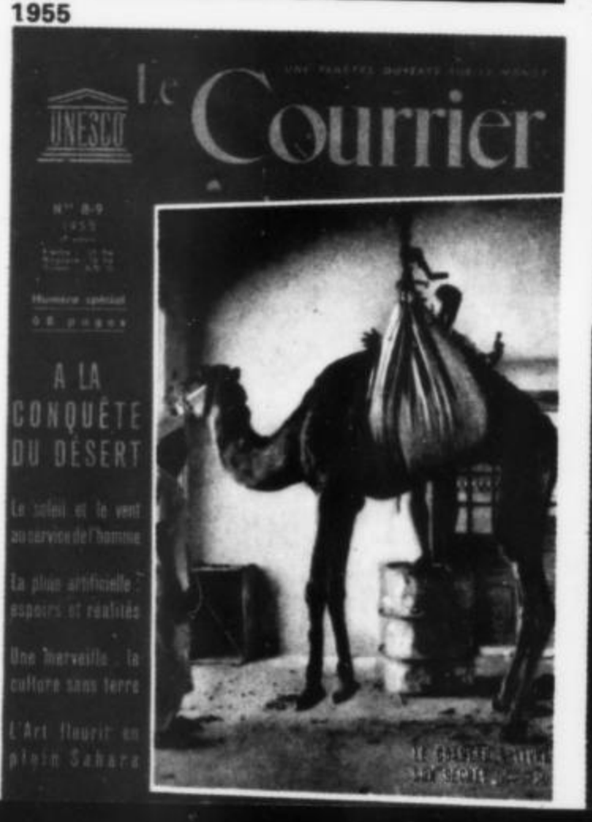

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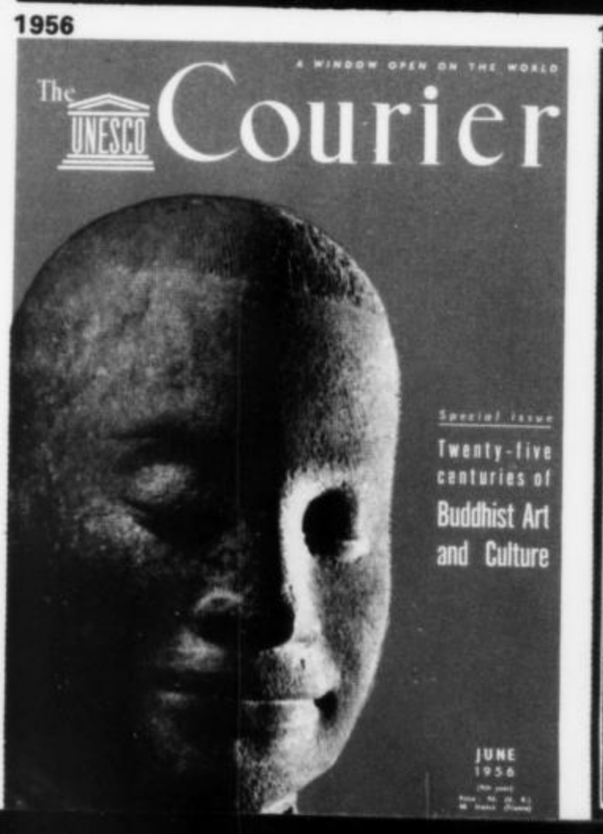

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PORTRAIT FROM A NUBIAN TOMB

This is the head of a man who lived and died in Nubia nearly 4,000 years ago. It is one of several funerary masks recovered from a necropolis near Mirgissa, in the Sudan, by a French archaeological mission which took part in the international campaign to save the monuments of Nubia. Following a Unesco appeal (launched in 1960), 40 archaeological missions from 15 countries explored sites in Egyptian Nubia for five years, while a dozen more worked in Sudanese Nubia.

Photo © André Vila
French Archaeological Mission

A WINDOW OPEN ON THE WORLD

The UNESCO Courier

AUGUST-SEPTEMBER 1969
22ND YEAR

PUBLISHED IN TWELVE EDITIONS

English — U.S.A.
French — Japanese
Spanish — Italian
Russian — Hindi
German — Tamil
Arabic — Hebrew

Published monthly by UNESCO

The United Nations
Educational, Scientific
and Cultural Organization

Sales and Distribution Offices
Unesco, Place de Fontenoy, Paris-7e

Annual subscription (any edition) : $ 5.00
Single copies : 50 cents

The **UNESCO COURIER** is published monthly, except in August and September when it is bi-monthly (11 issues a year) in English, French, Spanish, Russian, German, Arabic, Japanese, Italian, Hindi, Tamil and Hebrew. Sales and distribution: UNESCO Publications Center, U. S. A., P. O. Box 433 New York, N. Y., 10016, MU 6-4707 (sole distributors of the U.S.A. edition).

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The Unesco Courier is indexed monthly in the Readers' Guide to Periodical Literature and in Current Contents - Education, Philadelphia.

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N° 8 - 1969 MC 69-1-248 A

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A 21-YEAR ANTHOLOGY

"Ignorance of each other's ways and lives," reads the preamble of the Constitution of Unesco, "has been a common cause throughout the history of mankind of that suspicion and mistrust between peoples of the world through which their differences have all too often broken into war." For the past 21 years the "Unesco Courier" has sought by text and image to combat this suspicion and mistrust between peoples by telling the unheadlined story of men and women of different lands who are working together to conquer ignorance and disease, reduce racial prejudice, raise standards of living and foster better understanding of other peoples' ways and lives: in a word, to serve as a window opening on the world of education, the sciences, the arts, and communication, and the problems concerning the nations of the globe in seeking to resolve them.

The "Unesco Courier" began publication in 1948 with three language editions in English, French and Spanish. It has steadily grown until today it is proud to boast a total of 12 language editions—all identical in content and presentation—with a readership exceeding 2 million persons. A Russian edition was launched in Moscow in 1957; a German edition in Berne and an Arabic edition in Cairo were launched in 1960; a Japanese edition began publication in Tokyo in 1961; and an Italian edition in Rome in 1963; a Hindi edition in New Delhi in 1967 and a Tamil edition in Madras the same year; and a Hebrew edition in Jerusalem in 1968. A Persian edition produced in Teheran has been launched in 1969.

This special issue brings together a necessarily small selection of the many articles and features that have appeared in the past two decades. It is in no sense a history of Unesco. All articles have been shortened, sometimes drastically, and many articles have had to be omitted though they certainly deserve a place in this anthology.

THE EDITORS

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* *Attention of readers is drawn to a forthcoming book entitled "Eastern Cultures—An Anthology of the Unesco Courier" to be published end 1969 or early 1970 by Longmans Green & Co. Ltd, Great Britain. The contents and presentation of this work will be completely different from the present issue of the "Unesco Courier".*

** *Most issues published prior to 1968 are entirely out of print and cannot therefore be made available today.*

EARTHLINGS IN THE SPACE AGE

by Lord Ritchie-Calder

Photo © APN

BY his own ingenuity, *Homo sapiens*, the Earthling, has shrunk his world to the dimensions of a very small planet. In the arrogance of our conceit, which puts Man and his brain at the very centre of the universe, we have never been quite convinced by the astronomers when they have tried to tell us how insignificant the world is in the immensities of Space. But now the space engineers, and the astronauts, beating the bounds of our global parish, have reminded us how relatively small it is.

In the spirit of new adventure, one may regard the world as a departure platform for fugitives to the moon or a launching pad for escapades to other planets or even beyond our solar system, into other universes. But the Earthlings who cannot so escape must recognize that on its relatively limited surface, 3,000 million people today, 4,000 million in twenty years' time, and 6,000 million or 7,000 million forty years from now, will have to contrive to live and to work together. Or, by the neglect of wisdom or the abuse of human ingenuity, to die together.

An eye, human or electronic, in an artificial satellite in orbit, sees no political frontiers; no ideological curtains; and no differentiation of races. It might see H-Bombs going off as the signals of tensions; but in general it would see a globe of which only three-tenths was land and seven-tenths covered by oceans; mountain ranges reduced to wrinkles; evidence of surviving forests; tawny expanses of hot deserts which cover a fifth of its surface and cold deserts which cover another fifth. It might with difficulty distinguish the pattern of cultivation of arable or cropped lands, which accounts for only one-tenth of the land surface. That is the nature of humanity's family estate of which, at the moment, we are the improvident stewards.

The world is not just the relic of a cosmic incident. It provides the biosphere, the living space, for the evolutionary process which, we like to think, had its consummation in Man.

But with a wisdom which we have not demonstrated convincingly so far, we must recognize that that biosphere and that evolutionary process include other species with which we can coexist or which we can stupidly destroy. Stupidly because our relations with these other species are a condition of our own survival.

A lump of soil no bigger than a football contains a micro-organic population greater than the human population of the world. That micro-organic population includes the germs and fungi which evocatively suggest disease or danger but which, in other forms, are indispensable to our existence. In the same way, we think of insects as deserving insecticide and other creatures as deserving pesticide, but in the process we can kill those which are essential to our ultimate needs.

In order to get margarine, we cleared big areas in Africa of brush and tsetse flies which it harboured, but in the process we got rid of the bees which were needed to pollinate other crops.

Similarly, for our short-term, and short-sighted, needs we have destroyed the vegetation cover, preventing the absorption of water by the natural sponge through which it seeps into the underground springs. As a result the scouring rains sluice the soil off the hills, cause floods and eventual erosion.

In the lifetime of the United States, over two hundred and eighty million acres of arable crop and range land have been destroyed—more than ten times the productive acreage of the United Kingdom.

Only slowly—and recently—have we come to recognize that wild animals are not something with which mankind is at war but a part of the balance of life, which is delicately adjusted.

For the first time in history, man has the power of veto over the evolution of his species. We share the biosphere. Into that we have injected, in the past sixteen years, man-made radioactivity. Elements which did not exist in nature have been indiscriminately scattered over the face of the earth, to combine in all living things.

Today there is not a child in the world that does not have radiostrontium in its bones—at least to some degree. The amounts may be insignificant and the possible effects may be emotionally exaggerated and medically in dispute. Much is unproven, much is unknown. But that only emphasizes that men, on defective evidence or in positive ignorance, are recklessly tampering with the biosphere on which their present and future depends.

I have, in the past fourteen years, been among the wandering Bedouins in the desert, the Dyaks of Equatorial Borneo, the Eskimos in the Arctic, the peoples of the hinterlands of Latin America and Africa and Asia. In one way or another their lives and their destinies have been consciously touched by scientific and technological achievement.

Many of them have acquired their freedom—in 1962 there are nearly twice as many nations in the U.N. as there were when it was founded. But when the intoxicating effects of political independence wear off, there is the morning-after-the-night-before.

People are apt to wake up and discover that freedom has been robbed of its meaning; that they are just as hungry, or more hungry; just as poor, or more impoverished; just as sick or more disease-ridden, and just as frustrated in their seeking for a better way of life.

THROUGH the limited—financially that is—activities of the U.N. agencies, of the U.N. expanded technical assistance fund and now of the special fund and by the much more lavish examples of bilateral aid, people have been shown what is scientifically and technically possible. But it is not enough to show them.

To demonstrate what might be done to people who have not the means to do it is just tantalizing. It is just "window-shopping"—walking along with nothing in your pocket and with plateglass between you and the things you have been taught to want.

The peoples of the emerging countries have not the means to go shopping in the supermarket of science—as Prof. P.M.S. Blackett has termed it. They cannot even afford the bargain basement.

The object of this kind of assistance is to help people to help themselves—throwing them a rope with which to haul themselves out of the morass of poverty. But this is no Indian rope-trick—the rope has to be tethered to something, and a winch would help to haul them out more quickly. As it is, the rope is slipping.

After ten years of this new social philosophy by which governments acknowledged that they were responsible, not only for their own people, but for other, less fortunate peoples as well, the gap between the prosperity of the highly-advanced countries and the poverty of the countries struggling for development has not closed—it has

CONTINUED ON NEXT PAGE

LORD RITCHIE-CALDER *is a world famous science writer. He won the Unesco Kalinga Prize for the popularization of science in 1961.*

widened. The rich countries are richer and the poor countries are poorer—despite the thousands of millions which have been spent on aid.

Governments, when the markets skid, cannot "lift themselves by their own bootstraps" or, if they do, it is by duress. In the meantime their peoples will endure the Misery-Go-Round of Poverty.

By 1960 the total world stocks of surplus grain had reached the incredible figure of 125,000,000 tons—enough to provide the full calorie needs of 450,000,000 people for a complete year.

NO one should be so foolish as to think that the distribution of those vast surpluses, even if it were possible, would solve the problem of hunger. Relieving immediate stresses, yes. By distribution through such agencies as Unicef, yes. By turning food into currency, yes. Supplies of food can be made available to governments to help present needs and the proceeds can be used by a government to help its own agriculture to increase its yields in future years. That is the only permanent solution—to enable countries and regions to produce their food requirements.

It can be done. We do not need to imagine food artificially produced by photosynthesis. The scientific know-how already exists. The knowledge we have got, applied with wisdom, can increase the yields from existing acreages. By plant-breeding we can extend the food-growing acreages into what seemed inhospitable regions.

The Unesco Arid Zone Programme has done remarkable work in showing how deserts might be developed. I have no doubt, having been in the Arctic seeing whether it might become part of our habitable world, that production, if need be, can be extended there.

As far as those oceans which cover seven-tenths of our globe are concerned, we are at the cave-man stage. At sea we hunt our food and do not husband it. Sea-farming and sea-ranching are perfectly feasible.

The great international survey of the Indian Ocean, sponsored by Unesco, in which 25 survey ships of 15 nations took part, not only told us a great deal about that birthplace of the monsoons but also about its biological possibilities and its food prospects.

In 1961, the United Nations held in Rome a conference on "New Sources of Energy". Ironically, atomic energy was never mentioned. The *new* sources were the oldest of all—sun, wind and geothermal energy, the heat in the crust of the earth. It was a "Do-it-yourself" conference—telling the developing countries how they might contrive, improvise, and adapt methods of harnessing the sun and the winds to their domestic and industrial needs.

For the first time in history, Man, the Earthling, has the power of veto over continuing evolution. He can exercise that veto by the nuclear destruction of the race, or, by default in handling the problems of starvation, prove that Malthus was right.

He can ambitiously reach out to the farther planets, but his species as such must survive on the surface of the earth, subsist from the nine inches of top-soil which feeds, clothes and shelters him or from the seas from which he emerged hundreds of millions of years ago.

All the majesty of his mind can be dethroned by his stomach. Man can feast like Belshazzar and ignore the writing on the wall. He can spend £40,000 million a year on the defence of peace and ignore the real content of the peace he is supposed to be defending.

He can split the atom and release the power of matter and use this, his greatest discovery, to poison the goodness of his earth and destroy his species. He can outboast the Ancients, who in the arrogance of their material success built pyramids as the gravestones of their civilizations, for Modern Man can throw his pyramids into Space and they may orbit eternally around a planet which died of his neglect.

Or he may choose to use his science and his wisdom to co-operate with all his kind in the peaceful enrichment of his Earth and of the people who live on it.

— December 1962

THE STORY

A traveller approaching the Colombian port of Barranquilla on the Caribbean Sea sees Colombian soil long before he sights the coast.

The tropical blue of the sea changes to yellow as far as the eye can reach.

What gives it its yellow colour?

The port of Barranquilla lies on the estuary of the River Magdalena, which rises in the interior of Colombia and flows for a thousand miles to empty into the Caribbean Sea. The yellow colour is soil swept away by the Magdalena River within a radius of several miles round the port of Barranquilla.

The soil comes from the Magdalena Valley and from the slopes of the Andes enclosing the valley to the east and west. It has been washed away by rain and borne down brooks, tributaries and secondary rivers.

Part of it has been stripped by the River Magdalena from its own banks. Every day, every hour, even every minute, the wealth of a nation is cast into the sea.

Antonio Arango, whom I knew in the Andean Cordillera, was himself an actor in the tragedy of the vanishing soil, without understanding it.

Antonio Arango invested his life-savings in the purchase of a 20-hectare

GUILLERMO NANNETTI, *former Minister of National Education in Colombia, is now ambassador to Sweden.*

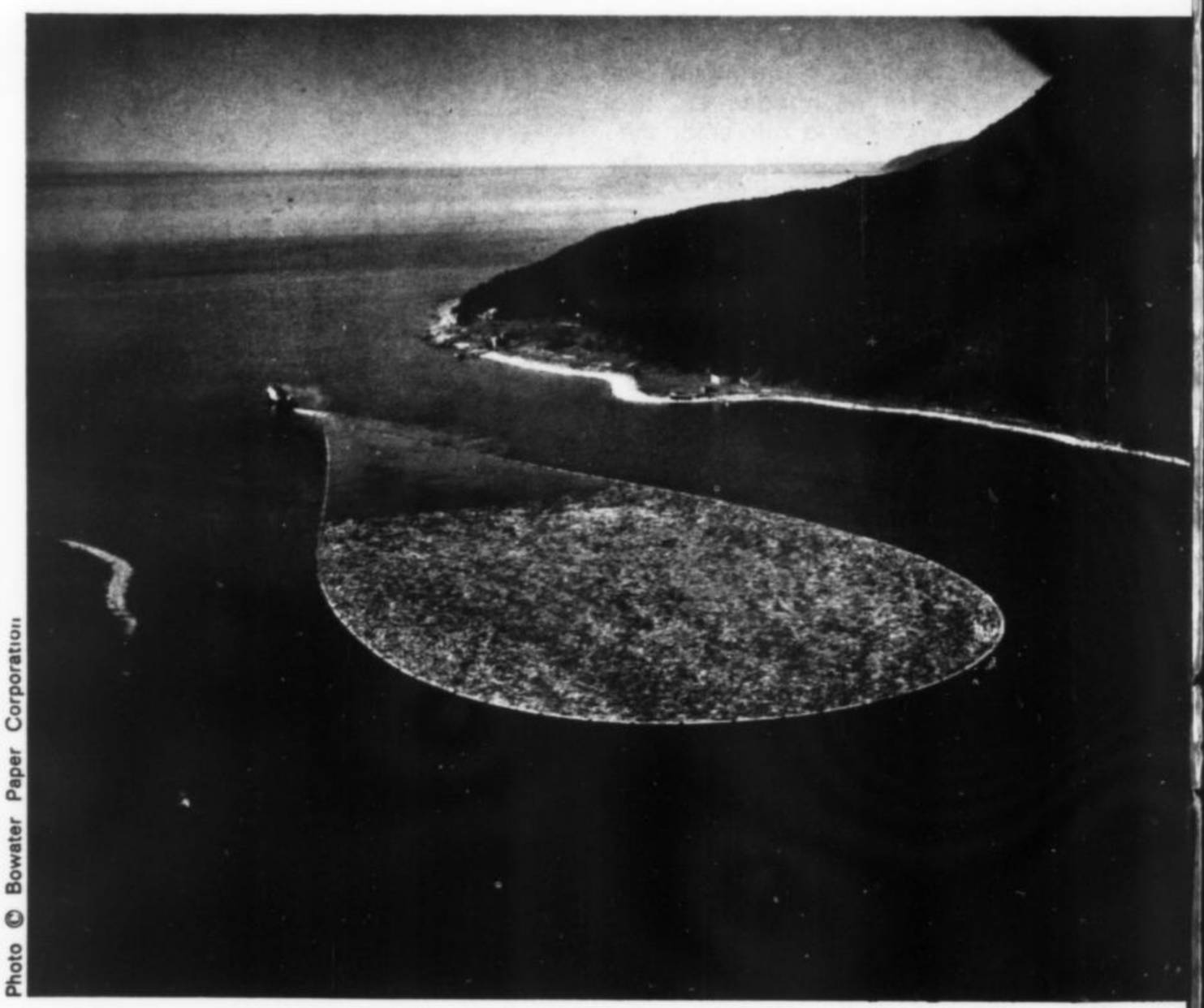


Photo © Bowater Paper Corporation

OF ANTONIO ARANGO

by Guillermo Nannetti

parcel of land in the Cordillera. The land was rich and fertile and covered with "tall timber". "Where such big trees grow", said Antonio to himself, "the soil is good", and he gazed with satisfaction at the thick stratum of top-soil which could be seen in the cutting made by the brook. The water was crystal-clear as it flowed through the undergrowth of moss and parasitic plants; so crystalline that Antonio and his sons christened it "Diamond Brook". The site was ideal for a house and allowed a view over the whole landscape.

Antonio Arango sharpened his axe and machette. His wife and three sons aiding him, he began felling the tall trees. The timber could not be used because there were no roads to transport it nor neighbouring towns to buy it. So Antonio Arango let a few days go by to let the sun dry the fallen trunks and then set fire to them.

Other settlers were doing the same in other parts of the mountain.

The blaze was enormous, and the beasts and birds of the forest fled before the flames as the fallen giants crackled in the fire.

At last the ground was cleared and Antonio Arango sowed it with maize. On two hectares he sowed forage for the cow, and built a house on the high ground. As his wife had worked so hard, Antonio gave his ranch her name, *La Isabella*. The first harvest was a big success. The maize was tall and thick. Antonio was pleased with his efforts. So he went on sowing maize.

But things began to change.

Diamond Brook, which had once been crystal-clear throughout the year, had shrunk to a thread of water in summer. In the rainy season it was a yellow flood tearing loose rocks and mud and lumps of soil. The harvests grew smaller, and Antonio Arango had to sell the cow because the pasture land could no longer feed the animal. Things were not going right at all.

One day, when he was sowing maize, his mattock struck solid rock. The vegetable top-soil had become so thin that rocky outcrops were appearing everywhere. Antonio had no money, the children had nothing to eat, and finally Diamond Brook vanished and only its stony channel was left. Like so many other settlers, Antonio Arango left to find another stretch of woodland to start all over again.

This tragedy of Antonio Arango is attaining national, continental and world-wide proportions. Every year Colombia loses the equivalent of 10,000 ranches of 20 hectares by soil erosion. That means that every year there are 10,000 families in the same position as the Arangos.

Vegetation is like an umbrella protecting the soil. It breaks the fall of the water and causes it to sink into the subsoil. The forest is the mother of the spring. The roots of the trees are like friendly hands sustaining the topsoil with their myriad fingers. Fallen leaves and fruits fertilize the soil and build up the vegetable humus. The trees afford protection from the wind, regulate humidity and give shelter from heat and cold. They prevent floods. They purify the air. They can be an inexhaustible source of profit to one who knows how to cultivate and utilize them wisely.

If only someone had told Antonio Arango to drive his furrows according to the contour of the slope. To terrace the steepest part of the slope. To heal the scars of erosion with simple dams of logs and stones.

If only someone had told Antonio Arango that maize is not the right crop for sloping ground and that other, better paying crops can be rotated instead. If only someone had taught him to sow the ground between his furrows with suitable bushes to check the movement of the soil.

And if only all the Antonio Arangos, all the N'boyas, Changs, Abdullas and Smiths all over the world knew something about the conservation of nature, what a different world it would be.

— *July 1949*

SAVING OUR VANISHING FORESTS

by Karl Heinz Oedekoven

AS far back as the unknown origin of mankind, the path of human activity has been marked by the thoughtless destruction of forest and vegetation. Civilizations have flourished and disappeared with a resultant depletion of trees and plants, leaving only steppe and desert behind. Only in recent centuries has man begun to realize that he was cutting off the branch that he was sitting on.

Man is becoming more aware today of nature's vengeance and, at the same time, of the challenge which confronts him in preserving his dwindling natural assets while endeavouring to extend the fertile earth which is the very basis of his existence. The demands of an ever increasing world population make his task more and more insistent.

The forest, our largest and most durable soil cover, was once regarded as only an obstacle to settlement, agriculture and communications. It was recklessly burned or exploited until it suddenly became a focus of intense human interest.

Man has come to learn that the two most important elements of his existence—soil and water—owe their stability and availability to the presence of sufficient forest cover.

Three-quarters of the world's population are undernourished. There is only about one acre of land per head for food production and no less than twice this area is needed to ensure satisfactory nutrition. The true Enemy No. 1 in the world is not a political or military opponent, but the deterioration of the soil, the dryness, the irresistible progress of semi-deserts and deserts.

In some countries, like the United States and the Union of Soviet Socialist Republics, soil conservation has become almost a "State religion". In South America, all over Africa, Asia and Australia there is great concern over dangers threatening the soil.

While political leaders come and go, this destructive process of soil deterioration remains a permanent menace. Each government inherits this problem from its predecessor. Yet, even today, the efforts of many countries to remedy the situation are merely in their infancy.

We know from the experience of 500 years that the Sahara desert progresses towards the south at the rate of over three feet a year on a wide front of 2,000 miles. Lake Chad, which some decades ago was still an ideal refuge for migrating birds from Europe, is steadily diminishing in surface area and depth and its shores are turning from fertile green to steppe brown. All far-reaching plans for the development of Africa as the "Continent of the Future", all plans for water use and industrialization will fail unless the necessary attention is paid to the importance of trees and forests.

Two extensive desert belts have developed along both sides of the equa-

CONTINUED ON NEXT PAGE

KARL HEINZ OEDEKOVEN *of the Federal Republic of Germany is a specialist on world forestry at the Food and Agriculture Organization, and is former vice-chairman of the European Forestry Commission.*

tor. The one in the south reaches from Australia to South Africa and South America. The one in the northern hemisphere spreads north from China, all across Asia, North America and Mexico.

The northern belt includes those nations which, as we learned in our history classes at school, were once rulers of the world. We were puzzled to hear in geography class that large areas of these once powerful nations are now sterile. The truth is, of course, that in ancient times they were not so.

Ctesiphon and Baghdad, once centres of concentrated power, were described by Herodotus more than two thousand years ago: "Of all the countries we know this is the most suitable for growing grain. It is so well favoured that it yields two hundredfold and, where conditions are best, even three hundredfold. The ears of wheat and barley grow to the width of four fingers. But to the height of what tree millet and barley grow I shall not disclose. No one who has not seen Babylon would believe me."

For Herodotus, Babylon was the essence of fertility. He also accorded the same honour to Cinyps, a region in North Africa: "This country produces grain equal to the best I have seen, for it has black soil and springs water it. The yield is equal to that of Babylon, three hundredfold under the best conditions."

Soldiers in the sandy and torrid conditions of this region (part of modern Cyrenaica) during the last war would have had difficulty in imagining that a now desolate desert was the richest of farming land two millennia ago.

THERE are three zones on the globe which successively were homes of dominating civilizations but where the soil became devastated in proportion to the age of their settlement.

The first zone is the desert of North Africa. In the Sahara, hundreds of archaelogical finds and cave paintings indicate that this was once a flourishing country of many lakes and rivers. One cave painting shows men swimming. Imagine swimmers in the Sahara desert today!

A second zone is the continuous range of stone, salt and sand deserts which spread from west China, across Turkestan, Afghanistan, Iran, Iraq, Jordan, Sinai and up to North Africa. In ancient times these latitudes were inhabited by Sumerians, Babylonians, Persians, Macedonians, and Phoenicians—names which are all connected with world power and wealth. The third zone covers Palestine, Syria, Asia Minor, Greece, Italy and Spain.

This epidemic of devastated soil seems to be a contagious one. Attempts at reafforestation in Spain, Italy and Greece would certainly have been more successful had the opposite shores of the Mediterranean still been covered with a wide belt of fertile land as once they were. But the terrible desert has already reached the shore of the Mediterranean on a wide front and sends out its drying winds to the European countries.

The ever-blue sky of Italy has not always been as blue. Some 2,000 years ago it was just as grey and cloudy as in northern parts of Europe and the complaints of the old Romans about frost and snow-fall—which seem so strange to those who know Italy today—were probably justified.

While once it took millennia, or at least centuries to deplete fertile land, modern history offers a striking example of how man can start and complete this disastrous chain-reaction in only a few decades. Hardly a century ago the U.S. farmer moved into the Middle West, full of initiative and energy.

At first, the existing forests seemed inexhaustible. They were cut down, houses and bridges were built, the wood was burned in locomotives, on ships and in stoves. Great quantities were felled and burned on the spot to make large areas of ash-fertilized farming land. Later, monocultures and tractors cleared away those clumps of trees and hedges which had survived.

Water ran off the land too rapidly, soil was eroded, floods occurred and drought appeared between rainy periods. This process was accelerated during the First World War when large areas of what remained of tree-covered prairie were ploughed up for more intensive wheat production.

After the war, part of this land was left idle, but there was no longer any deep-rooting grass or other soil cover to conserve the moisture and stabilize the soil. Storms swept the land from the Gulf of Mexico and Canada unchecked, for there were no forests to break their force. The wind carried away the fertile topsoil leaving only sterile layers and rocks.

The same thing happened to former forest areas. Without the protection of the trees, without the firm grip of their roots, without humus, the soil was carried away. In the south, where the frost which usually stabilizes the soil during winter seldom occurs, and where there is seldom snow cover to prevent the damage, soil and wind erosion had the same harmful effect.

Like a network of veins the first small gullies appeared in the soil, gradually deepening to real gorges. The process was repeated a million times all over the country until only naked rock was left in some regions.

Even today American rivers carry away so much fertile soil that an old Indian once said: "Our country is a new Atlantis; one day it will disappear in the Ocean!"

Erosion is only the first phase of a serious chain reaction which starts with the regression or disappearance of forests. Sediment deposited in reservoirs, water-courses, fields and cities is an important part of the total damage. This damage seldom comes to public attention because it is often invisible. Sediment increases the total volume and weight of flow in water-courses thus raising the height of flood peaks and their destructive power. In drainage basins and reservoirs, sediment can reduce water capacity in a short time.

INVESTIGATIONS made into the effect of silting on the capacity of dams in Algeria show several dams lost 100 per cent of their original capacity in a period of 74 to 96 years. Similar findings in the United States with respect to annual storage depletion in numerous dams indicate that from 0.09 to 31.53 per cent of original storage capacity is lost as a result of silting.

Recently a monograph on the Arno river basin, on which Florence is located, revealed that 2,670,000 tons of solid material are carried away annually by the water flow, thus causing an average lowering of land surface of almost one inch a year.

Silting is almost always associated with deforestation. Dams fed from completely wooded watersheds practically never silt up. Experiments carried out by the Tennessee Valley Authority in 1955 showed that after reafforestation and protection works had been completed, the volume of sediment carried down by the river was reduced by 90 per cent.

The forest also plays an important part in protecting the soil against wind erosion and sand encroachment. Dune stabilization by tree planting is a well-known practice in many parts of the world. It is true that almost any vegetation cover will stabilize loose soil and prevent it from being eroded by wind and rain, but forests are probably more effective because of their height, density, deep-reaching roots and permanency. There are indications that the presence of forests may increase local rainfall, though effects on a regional or continental scale have not been demonstrated.

The denser the forest, the greater will be its power to reduce wind velocity. One authority has proved this protective effect and noted reductions in velocity of over 85 per cent. In Italy, tests have shown that the Cecina forest reduced wind velocity by 56 per cent and a hardwood coppice in the same region was responsible for reductions of 89 per cent.

The importance of such protection against wind erosion can hardly be exaggerated. In dry periods and on bare land the particles of certain types of soil become so severed from each other that a strong wind can easily carry them away. The finer particles form clouds and the coarser particles, whipped by the wind, roll and bounce

over the surface of the soil. Their movement is halted whenever the wind slackens and they bank up in pits, ditches, canals and sunken roads, or in the neighbourhood of sheltering objects where they may suffocate crops.

This is only one of the perils of strong winds. Drying out of soil, direct damage to delicate products like fruit, and the distortion and stunting of exposed trees can all be traced to this cause.

It is a striking fact that a number of countries have never formulated a forest policy or passed a forest law, in spite of evident symptoms of soil deterioration and in spite of repeated warnings about the results of a further decline.

One of them comes from Professor Flatscher, scientist of the Academy for Soil Cultivation in Vienna. He has estimated that the world's forests produce about 1,600 million cubic metres of timber a year whereas the volume cut annually amounts to between 2,200 and 2,600 million cubic metres. This indicates that the annual fellings are about 50 per cent above the allowable cut.

Any private individual who sanctioned such improvidence would be held responsible for bad management and would certainly be heavily penalized. But mankind as a whole, it seems, can indulge in prodigal waste of this kind without being in conflict with any law.

The total forested area of the world is estimated to be about 10,000 million acres and these forests should be capable of providing reasonably adequate supplies for a population larger than now exists. But the provision of such supplies will entail the treatment of all productive forests as renewable crops, the opening up of forests which are not yet accessible and the cessation of the widespread devastation of forests which still continues.

Of the 4,000 million acres of the earth's original forest area which man has destroyed, 1,000 million might well be replanted especially since much of this land is to be found in places where the population is in greatest need of the products of the forest.

The cost per day of the second world war was a little over $500 million. The cost of one day of this war would reafforest at least 20 million acres, and the cost of 50 days would be sufficient to reclothe the entire 1,000 million devastated acres with proper tree cover.

Of course, no one is so naïve as to believe we are on the verge of any such undertaking. But we are in possession of scientific knowledge, industrial skill and technical equipment which could be used to spread the potential benefits of the forest to the uttermost ends of the inhabited earth.

— November 1961

Photo © CNRS, Paris

Lull in activity of one of history's most famous volcanoes, Vesuvius in the Bay of Naples, enabled air-photographer to take this strikingly clear shot of its crater. After the eruption of 79 A.D. which buried Pompeii, Herculaneum and Stablae, Vesuvius was less active until the great eruption of 1631. Since then it has never been really quiet.

THE MENACE OF 'EXTINCT' VOLCANOES

I have gradually become convinced of something that laymen and even professional geologists and volcanologists usually ignore and it fills me with dread—the prospect, some day soon, of unheard-of volcanic catastrophes. Geological evidence has finally convinced me that humanity has so far been fantastically lucky, and the catastrophes of Pompeii and St. Pierre de la Martinique are nothing to what awaits us. These were small towns compared with the enormous modern cities threatened at closer or longer range by a volcanic outburst—Naples and Rome, Portland and Seattle, Mexico City, Bandung, Sapporo, Oakland, Catania, Clermont-Ferrand...! Volcanoes regarded as totally extinct near these cities are dead only to eyes that cannot or will not see. A volcano may be less than a century dormant and people almost cease altogether to think of it as such. But volcanoes are geologically live; time for them is counted not in years or even in centuries, but in millennia and tens of millennia.

Centuries, hundreds of centuries might pass and Clermont-Ferrand, Rome or Seattle not be wiped out. But the interval might be much less...

— October 1967

HAROUN TAZIEFF

Belgian geologist and volcanologist

THE SALERNO SCIENCE SCHOOL OF THE NINTH CENTURY

by Riccardo Luzzato

WHEN the provinces of the Western Roman Empire were invaded by primitive warrior tribes in the fifth century, the great wealth of scientific knowledge created and accumulated by the Romans, Greeks and the older eastern civilizations seemed irretrievably lost to Europe. Yet, during the troubled centuries of the early Middle Ages there was established an international scientific organization which was to flourish for more than 500 years in the face of all the violent prejudice then prevailing in the Christian world.

During the ninth century, in the seaside town of Salerno, in southern Italy, a school was founded which was to renew and preserve medical knowledge for the world and provide an example of the practicality and importance of intercultural co-operation.

Records are incomplete about the early days of the Civitas Hippocratica, as the school was called in honour of the greatest physician of Ancient Greece. Modern historians generally agree however, in ascribing its foundations to four scholars: Master Adela, an Arab, Master Helinus, a Jew, Master Pontus, a Greek and Master Salernus, an Italian. Each taught in his language, which meant Latin for Salernus and Hebrew for Helinus.

The international character of the institution is illustrated by the fact that the nationality of many of its famous teachers was hardly known. At the Civitas Hippocratica, they were just teachers, and the thousands of students who came from Arabia, Africa, Spain, Britain, Palestine, northern France and other countries knew and cared little about the origins of their professors. This applies to Gabriopontus who died about 1050. Some historians think he was a Greek, others that he was a Lombard, others again that he was a Salernitan.

One of his best known successors, Constantinus Africanus, was born in Carthage and made long journeys to Syria, Egypt, Ethiopia and India, to bring the latest achievements of Eastern science to Salerno.

The passion for science at Salerno was strong enough to overcome more than one form of prejudice. A prominent figure of the early period was the woman physician Trotula, about whose personality little is known, although she left a number of medical treatises which were used as textbooks up to the sixteenth century and were first printed by Aldus in Venice in 1547. Other women too were admitted to the lectures and to study.

Doctor Trotula acquired such wide fame, that she became popular in old English literature under the name of "Dame Trot" and became Madame Trotte in the 13th century medical trouvère Rutebœuf (Le Dex de l'Erberie).

Further evidence of the universality of science, even in the so-called Dark Ages, was the long-continued collaboration of Christians, Moslems and Jews, during the whole of Europe's "crusading periods". To the average European of the Middle Ages, whoever did not belong to the orthodox Christian Church, whether he was a Jew, a Moslem, a Hindu, a pagan—or worst of all a heretic—was hardly considered as a human being.

Written records of the Salerno school show the influence of the great Arabian schools of the Orient and Mohammedan Spain. The Persian physicians Rhazes (865-925) and Avicenna (980-1037); and the Spanish Arabs Avenzoar (1113-1162) and Averroes (1126-1198), as well as the great Maimonides, a Spanish Jew (1135-1204), were intensively studied at Salerno. Two of the most celebrated Jewish physicians, the urologist Isaac Judaeus (9th or 10th century) and the oculist Benvenutus Grassus (born in Jerusalem in the 11th or 12th century) had studied and taught at the Salerno school.

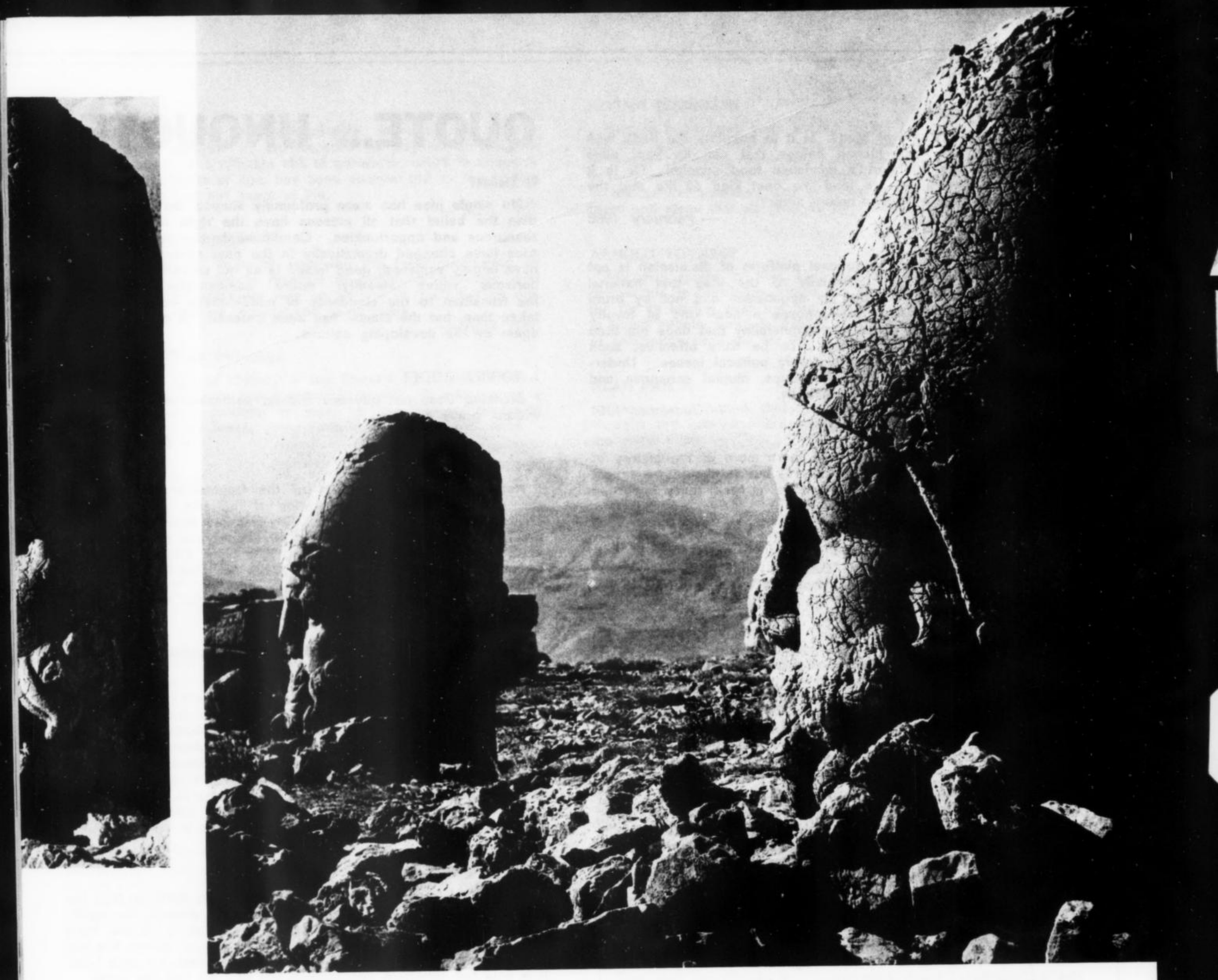
Salerno re-awakened a scientific spirit, independent of dogmatic doctrines; revived ancient texts, and inspired its students to a calm and critical appraisal of facts. Thus, Salerno paved the way for the great achievements of the universities of the Renaissance.

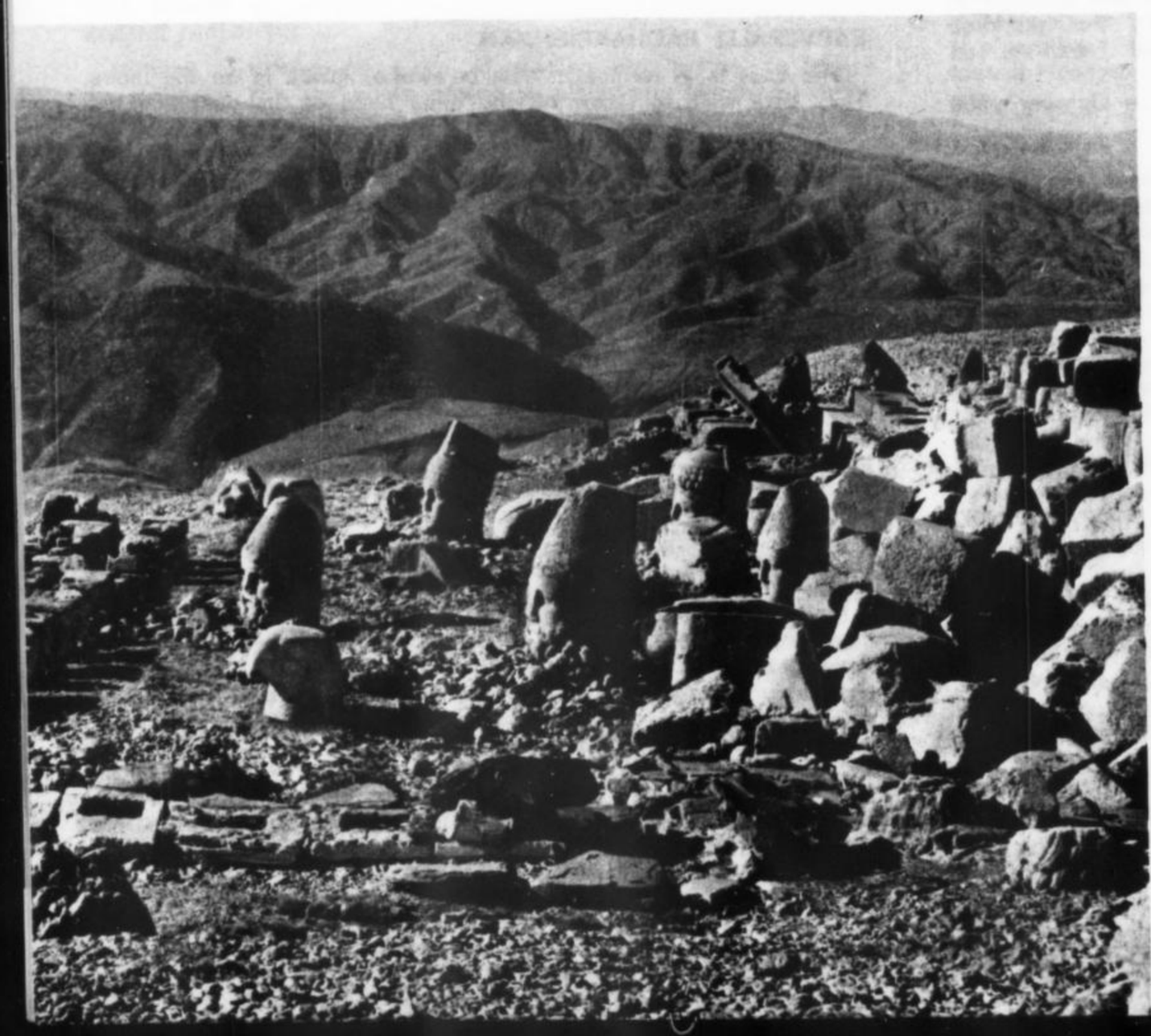
Its outstanding accomplishments and its lasting influence were possible because, right from the beginning, it overcame the towering barriers of religious and national prejudice and aimed to make knowledge available to the greatest possible number of people of all lands of the then known world.

— *July-August 1950*

THE RUINS OF NEMRUD DAGH

Photos © Ara Güler, Istanbul





Twenty centuries ago, Antiochus I, King of Commagene raised a mighty monument to himself and his gods atop Nemrud Dagh (Mount Nimrod) in the Anti-Taurus Mountains of present-day Turkey. Hewn from the mountain rock, the sanctuary consists of three terraces levelled on the summit and decorated with giant statues of Antiochus and the deities worshipped by his Greek and Persian ancestors. Above the terraces rises a great tumulus of rock chippings which archaeologists believe may hide the tomb of Antiochus, but so far this rocky cairn has defied exploration. The colossal statues guarding the secret of this Anatolian king still stand, but most have been decapitated. Left, fallen heads of deities litter the west terrace of Nimrud Dagh. Though now shattered by earthquakes, erosion and vandalism, the deities still seem marvels of engineering skill. Upon their platform, they rose as high as a five-storey building. Above, heads of Herakles (on left) and Zeus (right) are twice the height of a man. Above left, bearded Herakles (foreground) and handsome Apollo resemble giants buried to the neck in the rocky soil.

— February 1962

QUOTE... UNQUOTE

ARNOLD TOYNBEE

What is the true end of Man? Is it to populate the Earth with a maximum number of human beings that can be kept alive simultaneously by the world's maximum food supply? Or is it to enable human beings to lead the best kind of life that the spiritual limitations of human nature allow?

— February 1966

ALBERT EINSTEIN

The existence of a supra-national platform of discussion is apt to accustom the peoples gradually to the idea that national interests must be safeguarded by negotiation and not by brute force... a world federation presupposes a new kind of loyalty on the part of Man, a sense of responsibility that does not stop short at the national boundaries. To be truly effective, such loyalty must embrace more than purely political issues. Understanding among different cultural groups, mutual economic and cultural aid are the necessary additions.

— December 1951

BERTRAND RUSSELL

I do not deny that children must learn more of the history of their own country than that of others, but it should be taught in an international setting and not made to seem more important than other history.

— November 1949

CLAUDE LEVI-STRAUSS

If there is one notion that a European seeking to understand the problem of Asia must banish from his mind it is that of the "exotic".

— June 1952

JAWAHARLAL NEHRU

In a world which is full of conflict and hatred and violence, it becomes more necessary than at any other time to have faith in human destiny. If the future we work for is full of hope for humanity then the ills of the present do not matter much and we have a justification for working for that future.

— December 1950

POPE PAUL VI

When so many people are hungry, when so many families suffer from destitution, when so many remain steeped in ignorance, when so many schools, hospitals and homes remain to be built, all public or private squandering of wealth, all expenditure prompted by motives of national or personal ostentation, every exhausting armaments race, becomes an intolerable scandal. Would that those in authority listened to Our words before it is too late.

— August-September 1967

ALDOUS HUXLEY

Every industrial nation spends huge sums on research into the techniques of mass destruction. If comparable amounts of money and scientific ability could be devoted to the problem of producing food-stuffs artificially, it seems likely that methods would quickly be found for providing the [world's] half-starved millions with an adequate diet.

— October 1958

ADOLF HOFFMEISTER

Literature is like a river which crosses the landscape of life, reflecting the sky, the banks, the bridges, the boats and fishermen. Dickens is the Thames, Tolstoy the Volga, Sholokhov the Don, Faulkner the Mississippi.

— April 1967

PEARL BUCK

In the contact that is now inevitable between the peoples of the Occident and Orient the greatest change will come in the Occident. It will not be so visible, at first, as the change in the Orient. A refrigerator is a monstrously visible thing, but the change in man's attitude towards life is far more important and powerful.

— April 1950

YURI GAGARIN

I am firmly convinced that greater international co-operation is needed for the mastery and utilization of outer space so that each manned flight and each launching of a space station or laboratory for cosmic research can serve man in positive and peaceful ways.

— May 1966

WALTER M. SCHIRRA

There are no boundaries a hundred miles up, and there are none visible on earth when it is viewed from a space capsule.

— May 1966

U THANT

No single idea has more profoundly shaped the modern world than the belief that all citizens have the right to share in its resources and opportunities. Conditions in the developed countries have changed dramatically in the past century. The slums have largely vanished; good health is all but universal; educational horizons widen steadily; entire communities have made the transition to the standards of middle-class comfort. It has taken time, but the chasm has been crossed. It can be crossed again by the developing nations.

— October 1965

J. TORRES BODET

Mankind does not advance without setbacks, without retreats, without grave crises.

— December 1950

HENRY MOORE

Nothing is more significant of the fragmentary character of our civilization than the separation of the arts. And if a unity could be achieved, say, in the building of a new town, and planners, architects, sculptors, painters and all other types of artists could work together from the beginning, that unity would be artificial because it was imposed on a group of individuals and not spontaneously generated by a way of life.

— November 1952

JULES ROMAIN

If Leonardo da Vinci and Goethe had never existed, our conception of man would be lesser than it is.

— August 1949

BERTRAND RUSSELL

I am convinced that all higher education should involve a course in the history of science... If Homer and Aeschylus had not existed, if Dante and Shakespeare had not written a line, if Bach and Beethoven had been silent, the daily life of most people in the present day would have been much as it is. But if Pythagoras and Galileo and James Watt had not existed, our daily life would be profoundly different from what it is.

— February 1958

ILYA EHRENBOURG

Every child knows that Dante was wrong in thinking that the sun and the other heavenly bodies revolve around the earth. But every modern man with a spark of humanity in his heart knows that Dante was right, and that love indeed moves the sun and the other heavenly bodies, including the planet, not very large it is true but important nonetheless, the one we call the Earth.

— January 1966

SARVEPALLI RADHAKRISHNAN

The East is in ferment. Asia is awake, Africa is on the move. They both wish to throw off the dead hand of the past and join in the stream of human progress. There have been political and economic revolutions and also revolutions of awakened desires, of roused hopes. If these longings are not satisfied, if we are not able to bring about at least a partial fulfilment of these very legitimate aims that Eastern nations today have, there will be no security for peace in the world.

— December 1958

RENE MAHEU

Irrespective of what opinions we hold about the younger generation of today, governments can no longer ignore the millions of youth now erupting into the life of nations, nor can governments ignore the need, indeed the urgency, in erecting new educational structures, not as ramparts to maintain the status quo, but as broad avenues for integrating young people into the communities of the future.

— July-August 1965

J. BRONOWSKI

H. G. Wells used to write stories in which tall, elegant engineers administered with justice a society in which other people had nothing to do except to be happy. But a world run by specialists for the ignorant is, and will be, a slave world. By leaving science to be the vocation of specialists, we are betraying democracy, so that it must shrink to what it became in the decline of Athens, when a minority of educated men (who had to be paid to make a quorum) governed 300,000 slaves. There is only one way to head off such disaster, and that is to make the educated man universal in 1984.

— May 1956

PIERRE AUGER

The great reduction in communicable diseases and better nutrition have resulted in an increase in population and the human life span. The ultimate aim of geriatrics, which is concerned with the problems of age, has been summarized as the adding of life to years and not years to life.

— *April 1962*

SIR CHARLES JEFFRIES

Our only realistic hope of achieving the total eradication of illiteracy is by a complete reversal of traditional attitudes, and by regarding eradication not only as an end in itself but as one which must be attained at once and at all costs.

— *April 1968*

PRINCESS ASHRAF PAHLAVI

The ultimate aim of literacy is not literacy for literacy's sake. A literacy campaign is like a catalytic agent. It encourages a person and the community to want to improve standards of living which are no longer compatible with the modern world.

— *April 1968*

YEHUDI MENUHIN

I feel that music offers almost the best means and road to the understanding of other people because one is not sidetracked by misleading words or symbols which have already acquired so many meanings. I have seen American audiences go mad with the rhythm of Indian drummers—and that has done more to establish contact with India than all the words that might be said or the books distributed which people might or might not read.

— *November 1957*

ABDULLATIF AHMED ALY

Nubia from the days of antiquity has stood as an example of what man can achieve when his toil and ingenuity are pitted against the elements and an unfriendly climate. The Greeks and Romans sought in ancient Nubia to convert a barren, thankless region, doomed it might have seemed to everlasting poverty, into a source of spiritual and material wealth, strength and pride—a goal that is now being pursued by the architects of modern Nubia.

— *February 1960*

RENE CASSIN

A glance at the realities of life today is enough to show that no country, not even the most advanced can pride itself on fulfilling all the Articles of the Universal Declaration of Human Rights. Violations of the right to life, killings and massacres, the exploitation of women, mass hunger and starvation, the perpetuation of slavery, lack of proper education, disregard for freedom of conscience, opinion and expression, racial discrimination and segregation and many other abuses are far too frequent to be denied.

— *January 1968*

ANDRE MAUROIS

Nothing can take the place of reading—no lecture or image on a screen has the same power to enlighten. Pictures are a most valuable means to illustrate a written text, but they hardly enable us to form general ideas. Films, like the spoken word, flow by and are lost to us. Books abide, as life-long companions.

— *May 1961*

ANATOLY BLAGONRAVOV

It does not matter which country is first able to send an expedition to the moon or is responsible for some other success in space; the important thing is the benefit it will bring to people. The history of science shows that when outstanding scientific discoveries are made in any country, their further development is due to the joint effort of the scientists of the whole world. The conquest of space will be no exception.

— *May 1966*

PHILIP NOEL-BAKER

The use of the word "tactical" to describe nuclear weapons has done more than all the rest of the jargon put together to distort the thinking of the "experts" about the use of nuclear arms, and to lead the general public to accept what in 1945-46 almost everyone agreed was utterly unacceptable.

— *August-September 1967*

HANS KOHN

No civilization must think itself in exclusive possession of the true way and endowed with an infallible insight into the course of human history.

— *March 1952*

NORAIR SISSAKIAN

Certain fears have been voiced in the past—and unfortunately are still being repeated by some people—that our planet's sources of energy are being rapidly exhausted and that we shall be unable to feed an increasingly vast population. Present-day achievements in the natural sciences and in technology have answered these fears and show that all grounds for pessimism are unfounded.

— *July-August 1966*

ARNOLD TOYNBEE

My own guess is that our age will be remembered chiefly neither for its horrifying crimes nor for its astonishing inventions, but for its having been the first age since the dawn of civilization in which people dared to think it practicable to make the benefits of civilization available for the whole human race.

— *December 1951*

ALAN PATON

One must not think that apartheid and authoritarian control of thought and education are separate entities. They are one and the same thing.

— *March 1967*

ALFRED METRAUX

All the great civilizations of the world are hybrids. No matter how far back we go in history, we find that most of the changes that have taken place, even in the most primitive civilizations, have had their roots in contacts with other peoples. The greatest civilizations have been those that were flexible enough to absorb the largest possible number of foreign techniques and ideas.

— *July 1953*

JOSUE DE CASTRO

The world's underdeveloped areas: huge concentration camps of hunger and misery in time of peace.

— *May 1963*

M. F. ASHLEY MONTAGU

Never was there a stereotype more unsound than that enshrined in the view: "You cannot change human nature." On the contrary. Man is the most plastic, the most malleable, the most educable, of all living creatures; indeed, that educability is a species character of Homo Sapiens. Man is the learning animal and he is capable of learning and changing his views and his habits throughout his life.

— *February 1953*

RAOUL FOLLEREAU

The emancipation of the victim of leprosy, who has been held in terror for 2,000 years, will go down in history as a victory comparable to the emancipation of the slaves.

— *January 1961*

WILBUR SCHRAMM

Practising broadcasters and international legal scholars believe that a high degree of co-operation, tolerance, restraint, along with suitable agreements and administrative machinery, will be required if direct broadcasting from satellites is ever to be anything other than a piece of science fiction or a non-fiction fiasco.

— *February 1968*

NIELS BOHR

Through Albert Einstein's work the horizon of mankind has been immeasurably widened at the same time as our world picture has attained a unity and harmony never dreamed of before. The gifts of Einstein to humanity are in no way confined to the sphere of science. His recognition of hitherto unheeded assumptions even in our most elementary and accustomed concepts, means to all people a new encouragement in tracing and combatting the deep-rooted prejudices and complacencies inherent in every national culture.

— *March 1949*

NICOLAI SEMENOV

I feel sure that by the close of the century three new sources of energy will have been put to work and the first thermonuclear, solar and underground generating plants will have been built... I visualize life in the 21st century as an age of total electrification.

— *August-September 1963*

GILBERTO FREYRE

One of the most important factors that have contributed to the birth of the typical culture of Brazil is the fact that the Negro could consider himself as a Brazilian of African origin and not as an undesirable African who never should have come to Brazil in the first place.

— *August-September 1952*

CONTINUED ON PAGE 63

Photo © Tass - Kochetkov

ANTARCTICA INTERNATIONAL LAND OF SCIENCE

Photo © Trans-Antarctic Expedition

Above, Soviet tractor convoy sets off on 1,300 mile journey to the Pole of Inaccessibility, the point farthest removed from Antarctica's coasts, where the lowest temperatures on earth have been recorded (-83.3° C.). Enormous chasms, large enough to swallow up entire convoys, are a serious threat to trans-Antarctic expeditions. Left, Sno-cat tracked vehicle remains suspended across a deep chasm like a bridge. Explorer-technicians have devised scout tractors equipped with electronic detectors which reveal presence of invisible crevasses.

ANTARCTICA is a true landmark in history as well as in geography. It is as international now as science itself. The whole continent is inhabited only by scientists who have come from 12 nations with no purpose of conquest or possession. They share their data and discoveries, their equipment and supplies as well as their hardships with men from other lands. The continent is a vast area of nearly 6,000,000 square miles, approximately circular, and 3,000 miles in diameter—nearly twice as large as Europe, almost as large as South America. Over it all is the endless monotony of the age-old ice sheet, in places 10,000 feet thick. Here six thousand scientists are studying how the Antarctic influences world weather conditions, the world water balance, glaciers, ocean currents, etc., and are making measurements of the earth's magnetism, cosmic rays, the aurora and other phenomena of the upper atmosphere and of the earth's interior.

The exploration and study of Antarctica is one of the major aspects of history's greatest global operation in science—the International Geophysical Year (IGY) which began in 1957 and set out to observe and measure features of the earth and its vicinity, heretofore beyond man's reach. None of these problems can be investigated in the laboratories or from observatories of a single country. The winds on high, the rivers in the sea, the forces of gravity and magnetism, the radiations that bombard the earth from outer space, know nothing of national frontiers. If they are to be understood, it must be by the joint action of many nations. For the first time in history, this is now possible. It will change our concepts of the universe and our understanding of the forces that play upon and within the earth. A new age begins with the concerted action of many peoples and by the carefully organized researches of many thousands of scientists the world over. For the first time, the peoples of the earth have joined to study their common and fundamental scientific problems together.

— *September 1957*

GERALD WENDT
Science writer

Photo USIS - U.S. Navy

Scientists working in Antarctica wear full face mask and dark goggles as protection against wind, snow and ice. A nose can freeze in seconds under Antarctic temperatures. Another problem is perspiration which can cause a kilo or more of water to accumulate in clothing which later evaporates to chill the wearer or turns into ice.

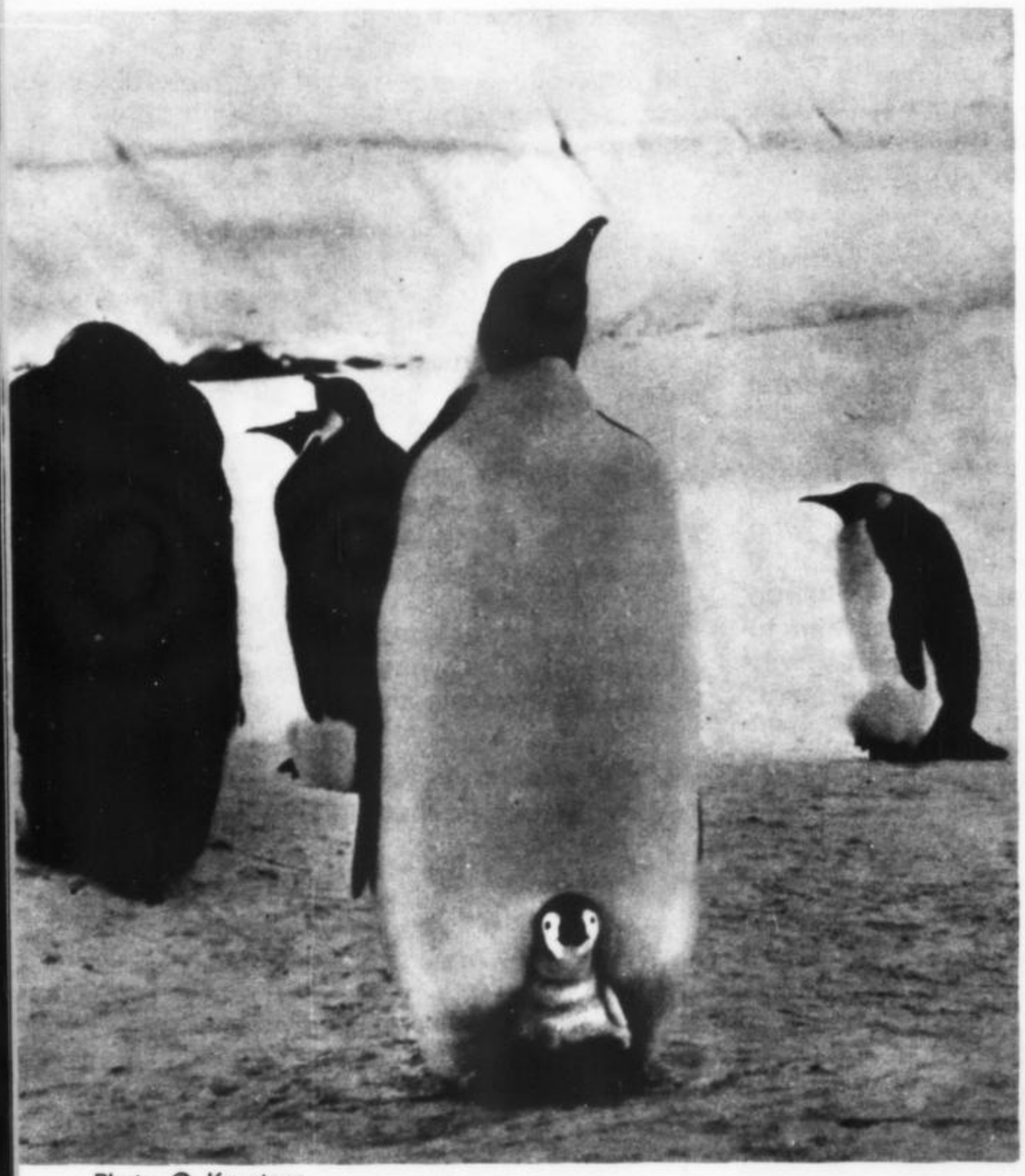


Photo © Keystone

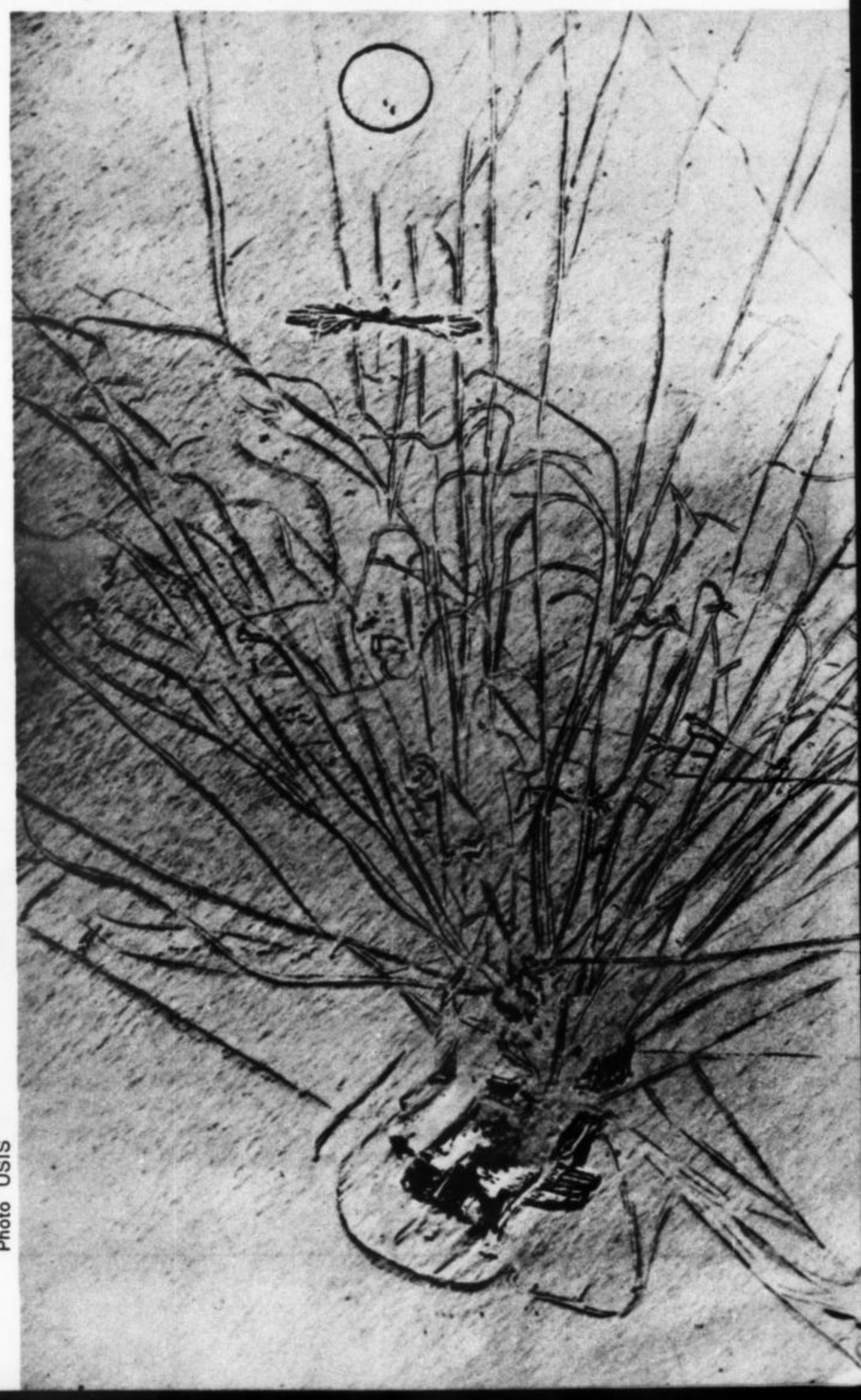


Photo USIS

Research stations at the four "Poles" of Antarctica were set up during the International Geophysical Year. France established one near the Magnetic Pole, the Soviet Union had one at the Pole of Inaccessibility and another at the Geomagnetic Pole, and the U.S.A. set up a station at the Geographic South Pole (air view right). Exact site of Geographic Pole is marked by circle of barrels (top of photo). Above, emperor penguins, largest of Antarctica's flightless birds (3 1/2 ft. high), warming chicks between their feet.

THE MYSTERIOUS HIEROGLYPHS OF EASTER ISLAND

by Alfred Métraux

EVER since a Dutch vessel chanced across it two centuries ago, Easter Island, no more than a speck in the vastness of the South Pacific, has intrigued the world with mysteries which have so far been only partially and tentatively explained.

For long the principal mystery of Easter Island lay in the colossal statues which still dot the bare slopes of the Rano-raraku volcano and which once stood in far greater numbers like sentinels over the mausoleums along the seashore.

In my opinion the greatest "mystery" of Easter Island is not to be found in the many colossal statues erected there. There is no doubt that the ancestors of the present Polynesian inhabitants hewed out these statues and dragged them to their present sites, abandoning the workshops where they carved them perhaps only three or four centuries ago.

However, no one has yet been able to give a satisfactory explanation for what appears to be a form of writing developed on the island.

This writing first came to light about 1860 when the people of the island, newly converted to Christianity, sent the Bishop of Tahiti, a Monsignor Jaussen, a long cord braided from their own hair, wound around an old piece of wood. Looking casually at the improvised spool, the Bishop was surprised to see that it was covered with small figures, all of the same height and carefully arranged in straight lines. These reminded him of Egyptian hieroglyphics, and he wrote to the missionaries on Easter Island asking them to look for other tablets and to try to decipher them.

Seeing how interested he was in this object, one of the islanders brought in a large tablet, perfectly preserved. Since then, other tablets have been found on the island and now total 24, including one large wooden rod covered with hundreds of symbols.

At the time when the first tablets were discovered, it would probably have been possible to obtain the key to the mystery from the surviving members of the priestly caste. The old civilization of Easter Island had only recently collapsed but there were still a few "wise men" alive who could have explained the meaning of the strange symbols on the tablets had they been questioned.

Unfortunately, the missionaries were not skilful investigators. They queried the islanders who, at the sight of the tablets, began to intone chants, instead of "reading" them. The missionaries treated them as frauds and lost interest in the matter.

Mgr. Jaussen, however, was more persevering. In Tahiti, he found an Easter Islander named Metoro, who had learnt the mysteries of the tablets under a famous master. The Bishop handed him a tablet and asked him to "read" it. Metoro turned it this way and that and suddenly began to chant.

He "read" the tablet from right to left, without bothering to turn it round, although in each line the signs are upside down in relation to that preceding or following.

Jaussen took down the text as Metoro recited it, and his manuscript was recently published. If each phrase is compared with the corresponding symbols, it appears that what Jaussen had taken to be a connected text is simply a disjointed succession of brief descriptions of the symbols viewed by his interpreter, and a series of isolated words or phrases suggested by those symbols. There is no logical development or general sense in the chant or recital. Mgr. Jaussen ended by losing heart himself and abandoned his efforts to get to the bottom of the mystery.

Other attempts were made to extract from the islanders information which might have made it possible to decipher the symbols. On a visit to Easter Island in 1886, an American paymaster, Mr. W. Thomson, was taken to the house of an old man called Ure-Vaeiko, who, in his youth, had attended the school of the Tangata rongo-rongo, (singers or bards) and learned to read the tablets.

Ure-Vaeiko consented to "read" photographs of the tablets, if not the tablets themselves. He recited their contents from end to end without a moment's hesitation. It was noticed, however, that he was paying no attention to the number of symbols in each line and, worse still, did not notice that the photographs had been surreptitiously changed. He went happily on reciting hymns and legends until he was accused of being a fraud.

Responsibility for these lost opportunities lies, not with the islanders, who appear to have acted in good faith, but with the early investigators, who were incapable of imagining a system of writing different from their own and were bent at all costs on having the tablets "read".

During my stay on Easter Island in 1934-35, I tried to discover, in the memories of my informants, some indication, however vague or apparently insignificant, which might have put me onto the right track; but it was all useless. The inhabitants had, it is true, assured me that the tablets were similar to the "cat's cradle" patterns, each suggesting a chant to the viewer.

I concluded that the tablets were

ALFRED METRAUX, *noted anthropologist and writer, won international fame for his work on Easter Island and amongst the Indians of South America, and his efforts on behalf of racial equality. He died in 1963.*

The strange "hieroglyphs" discovered on Easter Island are mostly engraved on wooden tablets or other wooden objects, like this fish. They depict stylized human forms, birds, fish, plants, shellfish and ceremonial objects, or sometimes geometrical designs. Easter Islanders can no longer read this ancient script or system of notation, and scientists have been unable to decipher it until now.

Photo © Musée de l'Homme, Paris

PIERRE LOTI AT EASTER ISLAND

On January 3, 1872, the French frigate "Flore" dropped anchor in Cook's Bay at Easter Island. On board was a 22-year old midshipman, Julien Viaud, who was later to become a famous novelist under the pseudonym Pierre Loti. The "Flore" had stopped at Easter Island to bring back to France the head of one of the huge statues, carved from soft volcanic stone, for which the island is famous (the head is now in the Musée de l'Homme in Paris). A skilled artist, Loti was assigned to make a series of drawings of the statues, the islanders, their dwellings and their tools and artifacts. He also did a number of drawings of the islanders' tattoo patterns. Loti drew two types of statues found on Easter Island: the now familiar bust type standing on the slopes of the crater of the volcano, Rano-raraku; and a long-bodied type which formerly surmounted the funerary cairns (ahus) that fringe the coast in an almost continuous procession. It was believed that, as a result of fierce inter-tribal wars, all the "ahu" statues were toppled over after 1838. This drawing by Loti, under which he wrote, "Easter Island, 7 January 1872, about 5 a.m.; inhabitants watching me arrive," shows that at least five of the statues were still undamaged in 1872. The sketch also shows inhabitants with Easter Island tattooing, a Janus-headed dance paddle or club, and various hair styles: tuft or pompom arrangement and diadem of rooster feathers. Human skulls (foreground) were then found everywhere on the island. Loti also drew a group of five statues atop a burial platform made up of four superimposed terraces; each statue wore a cylindrical head-dress of volcanic tufa.

— *August 1957*

mnemonic pictographs used in reciting the genealogies and sacred hymns which form a large part of the Polynesian liturgy. I was all the more inclined to this interpretation because, in the Marquesas, which are probably the original home of the Easter Islanders, the singers or bards associate their liturgical poems with small fibre pouches from which hang thin knotted cords. It was thus possible that each symbol on the tablets represented a sentence, a line or even a stanza.

This, then, was the hypothesis I had arrived at and which was accepted by other anthropologists. But I am less sure now that my interpretation is right since receiving a letter from a German anthropologist, Dr. T.S. Barthel, suggesting that the system used by the Easter Islanders was far more complicated than mere picture-writing, and could be a real script, part ideographic part phonetic, using the rebus somewhat in the fashion of the Mexican and Mayan scripts. According to this interpretation, the script consisted of symbols indicating the general meaning of a sentence by the use of a number of key words.

A Hungarian linguist, G. de Hevesy, has pointed out similarities between some of the Easter Island symbols and the undeciphered script of the Mohenjo-Daro and Harappa civilizations which existed in the Indus Valley some six thousand years ago.

The Austrian scholar, Professor R. Heine-Geldern, considers it doubtful that a direct link exists between these two scripts since there are far more symbols that are different than symbols that are the same. His archaeological research led him to believe that the Polynesian civilizations originated in China, and it was there that he sought the origins of their system of writing.

Heine-Geldern compared the symbols of Mohenjo-Daro and Easter Island with those of the earliest Chinese writing found on oracle bones and shells dating back to the second millennium B.C. He found that some of the symbols were common to all three scripts and concluded that the writing of Easter Island had been transported to the Pacific by a people from southern China possessing a system of writing that may have originated in central Asia or Iran.

Heine-Geldern also compared the Easter Island writing with the pictographs still used among the Cuna Indians in Panama. The famous prehistorian, Dr. G. von Koenigswald, has pointed out similarities between the Easter Islands symbols and certain drawings on fabrics in Indonesia.

I think it is fairly easy to discover curious similarities between scripts of the pictographic type. The very fact that it is so easy should put us on our guard. Whatever the true nature of the symbols on Easter Island's tablets, I believe that the scribes who made them sought their models in the Island's natural and cultural environment.

To me, all the indications seem to be that the writing of Easter Island was invented on that remote little island itself, probably on the basis of some mnemonic system brought by the ancestors of the Easter Islanders from their original home.

If it is ultimately proved that these symbols are indeed hieroglyphics which can be "read", then the Easter Islanders, who have already amazed the world by the quality of their art and the impressive proportions of their monuments, could claim the additional honour of having by a stroke of genius taken a decisive step in the development of civilization.

— *July-August 1956*

THE GALAPAGOS ISLANDS: LIVING LABORATORY OF EVOLUTION

by Jean Dorst

IN 1837, after a five-year voyage aboard the *Beagle* in the waters of South America, the Pacific Islands and Australia, Charles Darwin wrote in his journal : "In July I opened my first notebook on transmutation of species. Had been greatly struck from about month of previous March on character of South American fossils and species of Galapagos Archipelago. These facts origin (especially latter) of all my views."

Thus, the Galapagos Archipelago, lying some 600 miles out in the Pacific west of the coast of Ecuador, to which it belongs, directly inspired the famous British naturalist.

Superficially, this tiny archipelago appears to have nothing of particular interest to the scientist. A few dots on most maps (their total area covers less than 3,000 square miles), the 13 islands of the Galapagos group include five which are fairly large (the largest is Albemarle Island, 60 miles in length). numerous islets and rocks. Of volcanic origin, they are the peaks of a range of submarine volcanoes thrust up from the sea by successive eruptions.

Though close to the equator, the Galapagos Islands are washed by fairly cool seas from the famous Humboldt Current which brings cold water from the Antarctic along the coasts of Chile and Peru, then turns west at the equator and runs towards the Galapagos Islands, after which it loses itself in the ocean depths.

The fauna living in the archipelago is limited to very few species. As these species were isolated by large stretches of ocean from the dawn of history, they form a world apart—which has followed its own evolutionary laws shut off from the rest of our planet. Plants and animals arrived there from the American continent as best they could, swimming, flying or borne by the winds on natural rafts composed of a tangle of tree trunks and deadwood like those often carried along by many big tropical rivers.

The ocean crossing must have been a difficult enterprise and, in fact, only a limited number of creatures made the voyage safely. This explains the paucity of the Galapagos fauna and flora, especially as compared with the luxuriance of tropical America.

It may thus seem surprising that biologists regard these apparently barren islands as a scientific wonderland. But the scientists are right, for the Galapagos Islands are no less than a natural laboratory in which the process of evolution can be clearly observed. As the botanist, J.T. Howell, so rightly said they are the workroom and show-window of Evolution.

Being so remote, the Galapagos

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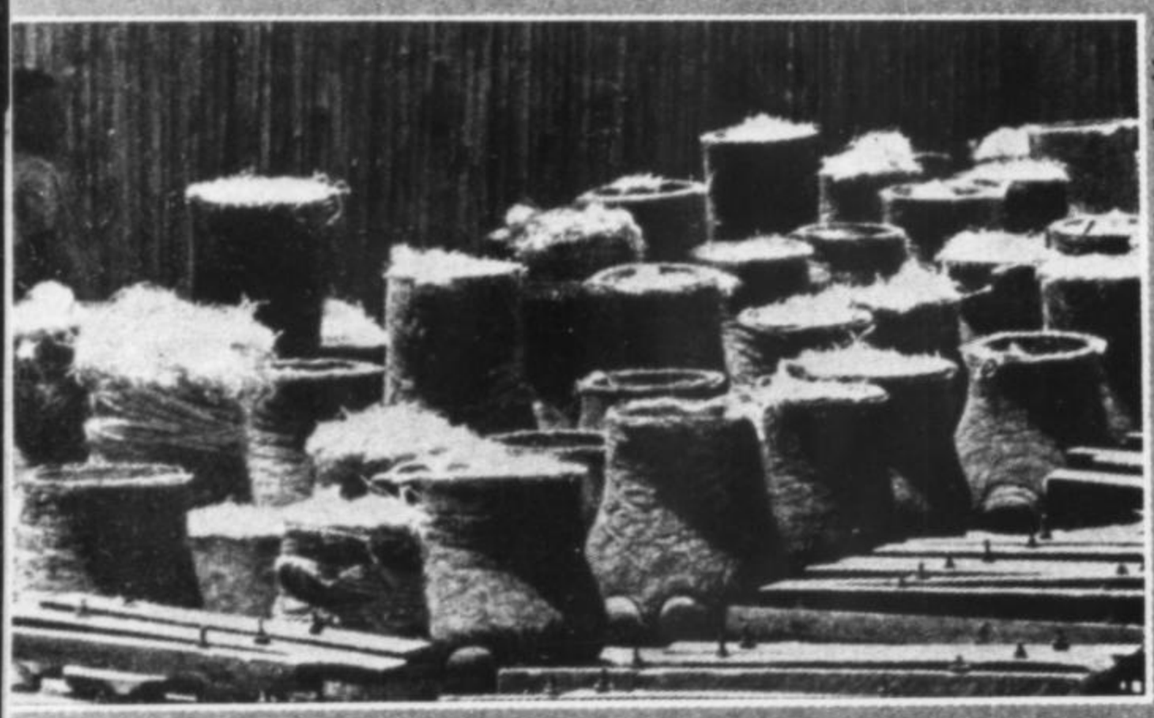

Photo Dr. B. Grzimek © Tierbilder Okapia, Frankfurt

Elephants' feet turned into waste-paper baskets for sale to tourists. Elephants have been known to tear half their trunks off in frantic efforts to escape the poacher's wire snare.

POACHING: THE SHOCKING SLAUGHTER OF AFRICA'S WILD LIFE

Poaching today in Africa is a large-scale illegal trade in slaughtered wild animals. It is by no means confined to killing for meat; all too often it takes the horrible and wasteful form of merely taking the valuable trophies such as rhino horn, wildebeest tails or elephant ivory, and leaving the slaughtered carcasses to rot. The poacher's methods are not only wasteful, but extremely cruel. Gangs of bowmen with poisoned arrows wait near a waterhole or at a gap in a prepared barrier, and shoot large numbers of animals which then die an agonizing death. Pitfalls are worse. The large number of animals that fall into them suffer a much more lingering death. Wire snares are the worst of all. Animals die a slow and horrible death, sometimes beset by vultures and hyenas. The abolition of this shocking trade is becoming just as compelling an aim in the Africa of the present as was the abolition of the slave trade in the Africa of a century ago. Like the slave trade, it is profitable, highly organized, extremely cruel and quite ruthless.

— September 1961

SIR JULIAN HUXLEY

The spectacle of iguanas basking on the rocks of the Galapagos is like a flashback to the earth's reptile age. After visiting the islands in 1841, Herman Melville, author of "Moby Dick" wrote: "...Little but reptile life is found here; tortoises, lizards, immense spiders, snakes, and that strangest anomaly of outlandish nature, the iguana."

Photo © Dr. I. Eibl-Eibesfeldt

Islands have served as a refuge for animals of an archaic type and for a biological environment which has vanished everywhere else in the world. As mammals could not reach these islands, the reptiles developed, unhindered by natural selection or predatory animals.

The scene that unfolds before one's eyes on setting foot on these shores recalls the prehistoric era of the age of the reptiles. Along the beaches live marine iguanas 3½ feet long, the only marine saurians still in existence. They feed on seaweed, grazing at low tide and bask in the sun in colonies sometimes running into hundreds.

In the interior, land iguanas of a different type live amongst the cactus along with the giant tortoises which are such a characteristic sight that their Spanish name, "Galapagos", was applied to the islands. These giants, whose shells alone measure 3½ feet, are now found only in the Galapagos Islands and the Seychelles, though fossilized remains extend over a vast area covering North America and Europe.

The remoteness of the archipelago resulted in a simplification of the fauna thus making it easier to follow the laws of evolution here than anywhere else in the world. Elsewhere the complexities of nature and the diversity of forms have made it virtually impossible to trace the lineage of many species. The Galapagos Islands thus stand out as Nature's great experimental laboratory.

This is particularly true of the famous Darwin finches, or *Geospizidae*, sparrows indigenous to the Galapagos Islands. The Islands' 14 species are all derived from a common ancestor, which obviously arrived there at a time when there were no other birds. The Darwin finches strikingly summarize the whole process of the evolution of sparrows.

Owing to the paradoxical conditions of the natural environment—mainly due to the presence of cold currents at the equator alongside masses of warm water—fauna of very diverse origins have crossbred on these islands.

Here penguins, usually associated with the Antarctic, rub shoulders with frigate and tropic birds found near warm tropical waters. The combined presence of creatures having such widely different origins and ecological preferences is an important factor in the evolution now taking place. These peculiar circumstances enable us to study at first hand the adaptation of animals to their environment.

Yet the situation of the fauna and flora is so precarious that this unique biological complex is threatened with extinction. Up till the sixteenth century the islands remained untouched by man. Then came successive waves of pirates, buccaneers and settlers—mostly mutineers or ex-prisoners.

FORTUNATELY the present population is made up of law-abiding and friendly settlers, but like many people elsewhere they know little about nature conservation. Furthermore, they have introduced animals previously unknown to the islands, most of which are now overrun with goats, pigs, dogs and cattle bred from domestic animals turned wild, not to mention the rats and mice introduced accidentally. So in addition to the direct depredations of man, the natural fauna has had to face the vigorous competition of animals better equipped for the struggle for life than reptiles.

Everywhere in the islands the reptiles have diminished in number—especially the tortoises. In former times they were massacred for their fat; now their eggs and young are devoured by the dogs and pigs. Some species are already extinct, while others are in a precarious situation. The fauna as a whole is seriously threatened. We are in danger of seeing a priceless natural heritage disappear before our very eyes.

As early as 1934 this state of affairs alarmed the Ecuadorian Government, which passed laws to protect the Galapagos fauna and flora and setting aside most of the islands as national parks. Unfortunately these regulations were hardly applied. After the Second World War, Ecuador turned to Unesco and the International Union for the Conservation of Nature and asked them to send a mission to study the islands, and to suggest ways to preserve the Galapagos fauna and flora.

In 1959, Unesco founded the Charles Darwin Foundation for the Galapagos Islands with headquarters in Brussels, and in 1960 began construction of a biological station on Indefatigable Island (Santa Cruz), both in co-operation with the Government of Ecuador.

New legislation introduced by Ecuador has now proved effective. Large areas have been decreed natural reserves, notably Narborough Island (Fernandina), which has retained it original appearance, and the western part of Indefatigable Island (Santa Cruz), where tortoises are still fairly numerous. The Foundation will continue to suggest to the Ecuadorian authorities measures aimed at protecting and conserving a natural complex found nowhere else in the world and is also carrying out extensive research in zoology, botany, soil biology and marine life.

The combined efforts of scientists from all over the world are in this way making up in some measure for the depredations committed by other men. The Foundation stands as a monument to Charles Darwin, whose evolutionary theories were conceived on the desolate shores of this tiny volcanic archipelago.

— September 1961

THE HERITAGE OF H.M.S. BOUNTY

by Harry L. Shapiro

Photo © Musée de l'Homme, Paris

The rugged shoreline of Bounty Bay on Pitcairn Island. Here nine of the mutineers of the "Bounty", led by Fletcher Christian, and 18 Tahitian men and women found refuge and established a colony which still stands as a remarkable example of racial harmony.

PERHAPS the most widely known of all cases of race mixture is the small group of Polynesian-English origin that lives on Pitcairn Island, in the South Pacific. Here, on a tiny volcanic island only about two miles long and about half as wide were resolved the train of events that the mutiny on the *Bounty* set in action.

This episode, famous in British naval annals, occurred in the year 1789 shortly after "H.M.S. Bounty" had departed from Tahiti where she had been dispatched under the command of Lt. William Bligh to collect bread fruit plants.

After six successful months in Tahiti, with the ship's hold full of potted trees, the return trip was interrupted by the mutiny of twenty-five of the crew of forty-four. The mutineers were led by Fletcher Christian, one of Bligh's officers.

The mutineers seized the ship, put Bligh and those faithful to him adrift in a small open boat and reset the *Bounty's* course for Tubuai, an island 300 miles south of Tahiti. Here an abortive attempt was made to establish a settlement, which failed because of the hostility of the islanders.

Returning to Tahiti, the mutineers split into two groups: one, consisting of sixteen men, remained in Tahiti; the other nine, headed by Christian, together with twelve Tahitian women and six Tahitian men, set sail from Tahiti in September 1789 to find an unknown island where they could hide.

For 19 years, until 1808, they were virtually lost to the world. In the latter year, their retreat on Pitcairn, some 2,500 miles south-east of Tahiti, was discovered by Captain Meyhew Folger.

During this interval much had happened on the island. All the Tahitian men and all but one of the Englishmen had died—most of them violently and after only a short sojourn in their new home. In addition, Folger found eight or nine surviving Tahitian women and twenty-five children, offspring of six of the Englishmen and their Polynesian wives. None of the Tahitian men had left issue.

From this handful of children, half Polynesian half English, the little colony increased until fifty years later there were almost 200 inhabitants on the island. Fear of over-population and the recurrence of water shortages induced them to request of the British Government the use of Norfolk Island, some 4,000 miles to the west, as a new home. This considerably larger island was uninhabited.

In 1856, the entire colony moved there, but subsequently several families returned to their beloved Pitcairn. In 1864, there were 45 descendants of the mutineers living on Pitcairn, the remainder having continued on Norfolk. At present, there are on both islands about 1,000 descendants of the original colony, not counting those who have married out of the community or settled elsewhere.

As an example of race mixture the Pitcairn Islanders are far from typical. But it is the very singularity of the colony that is full of meaning in interpreting race mixture as we commonly see it. Simply as a cross between Polynesians and English they can be matched in many parts of Polynesia where the same kind of mingling has occurred, often with notable results, as in New Zealand.

But unlike all other mixtures of this kind in Oceania, and indeed unlike virtually all race mixture wherever it occurs (1), the Pitcairn Islanders have lived and developed their common life completely separated from the societies from which they were originally derived.

The entire community was of the same mixed origin, was free of any social structuring imposed upon them by a larger society and escaped the influences that prejudice subtly works upon its object. This, then, is a community where social prejudice, at least, is not a factor to be considered and where we can study the consequences of race mixture divorced from the concomitant effects that being a part of a larger group might impose.

For the first eighteen years of its existence, the Pitcairn colony remained unvisited by any ship. The children growing up in the first generation of the community had never seen anyone not a member of their little family, for the early colony lived as one extended family with John Adams, the surviving mutineer, as their *pater familias*.

Even after 1808 when their existence became known, callers were rare and their visits very brief. Not until the 1820s did ships begin to call at Pitcairn to obtain water and fresh foods. As American whaling became increasingly active in the Pacific these visits increased in number, reaching their highest frequency in the 1840s.

With the decline of whaling, Pitcairn once more reverted to its former loneliness. These contacts, although important in bringing to the islanders the goods of the outside world for which they had acquired

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(1) The only parallel to Pitcairn known to me is Tristan da Cunha where a community of mixed Negro-Europeans have lived in isolation for well over 100 years.

a taste, were brief and had little or no influence on the social structure of the colony.

To anyone visiting the island, it is evident that here is a well-organized settlement, conducting its own affairs successfully under a system devised by the islanders themselves. There is no trace of a people conscious of inferiority.

Remarkable in so small a community, especially one cut off from the developments of the outside world, are some of the social institutions which were established on Pitcairn and maintained there ever since.

A democratic rule developed early with all men and women enjoying equal political rights, long before political rights were granted women in the Western World and indeed before they were even seriously discussed there.

Education was from the first recognized as a necessity and all children were required to attend school until their sixteenth year. The various families on the island were taxed for the maintenance of the school. Teachers were selected from the students and supported by the revenue levied on the people. Here, too, the Pitcairn Islanders were in advance of educational developments in greater centres of civilization.

THE culture that emerged on Pitcairn also reflected the mixed origin of the colony and in a rather striking way illustrates the decisive rôles that sex and environment may play in creating a new society. The cultural resources available to the new colony were, of course, English and Tahitian. But it is obvious on reflection that not all the content of either of these cultures could or would be drawn upon since one culture, the English, was accessible only through men who were sailors by occupation, and the other, the Tahitian, was represented by women who were familiar with the crafts and skills traditionally exercised in Tahiti by their sex.

In addition to this, the colony on Pitcairn faced an environment unlike the seats of either people, and in transplanting their traditional ways both the Tahitian women and the English sailors found themselves without the usual technical equipment needed to practice whatever skills and arts they knew. Even such a basic and necessary object as a nail was not available, not to mention a variety of common tools that could not be fashioned on Pitcairn.

Thus, we find tata cloth universally used by the colony in its early days. The making of this bark cloth is traditionally a woman's job in Tahiti and could be carried to Pitcairn intact. Similarly, cooking being a woman's concern, the Tahitian technique of an underground oven was standard on Pitcairn.

House building, on the contrary, was the result of a complex of influences. The Tahitian style of house would have been unsuitable in the colder climate of Pitcairn, but in any event it probably could not have been built by the women who in Tahiti leave the framing of a house to the men. The Englishmen, probably only as adept in carpentry as sailors of those days might be expected to be, were handicapped by the lack of essential building materials and hampered by the lack of tools.

We find them as a consequence building houses ingeniously put together, the frame mortised, the walls constructed of roughly hewn planks fitted into slotted uprights, the interiors provided with bunks as in a ship's cabin. The roof, however, was thatched in the Tahitian manner since roof thatching is prepared in Tahiti by the women and this was a contribution the Tahitian women on Pitcairn could make to this novel house.

One of the common allegations made about race mixture is that it produces inferior human beings. This belief is stated in various ways that all come to the same thing: mixed bloods combine the worst features of both parental groups, they are inferior to both stocks, or, at best, they are intermediate and therefore a debasement of the superior group.

In the mid-19th century the typical reaction was delight in finding so moral, upright and virtuous a colony sprung from mutineers, from violence and from murder. Nowadays, being less concerned with religious matters, with on the whole rather different values, the present visitor is less impressed by these qualities and is likely to prize other aspects of their character.

For my part I can report that, allowing for their isolation and for a consequent lack of sophistication, I found the Pitcairn Islanders an intelligent and attractive people. And I was struck by the number of men and women of impressive character, possessed of the qualities that make for leadership.

Although biologically rather more of what might be called objective information is accessible, still it can only be used for comparative purposes with caution. Even such standard criteria as physical vigour, longevity or health cannot be properly used for such purposes without reference to diet, climate and various other environmental conditions.

Both on Norfolk and Pitcairn Islands the physical condition of the islanders was excellent. In spite of the inbreeding, which has especially characterized Pitcairn, I found no physical deformities or obvious signs of degeneration.

On Pitcairn with a population of 200 (1936) there were no cases of serious mental deficiency. This is an excellent record compared with the frequency of such cases in Europe and the United States, especially in remote, inbred villages.

In view of the fact that neither on Pitcairn nor Norfolk is there any resident medical service or even trained nursing aid, the longevity of the population is impressive.

There have been some claims that children of race mixtures are smaller and weaker than their parents. The Pitcairn and Norfolk evidence is quite the contrary. Indeed, there is evidence here of hybrid vigour comparable to the vigour that can be demonstrated experimentally in a large number of animal and plant crosses and which is real enough to be commercially valuable to seed companies.

For example, if we take size as a measure of heightened physiological vigour as is done for maize or crossbred domestic animals, we find that the average stature of the parental groups is 171.4 centimetres for Tahitian males and 170.6 centimetres for the mutineers (based on British Admiralty records). The modern Englishman averages around 172 cms.

Stamp showing Pitcairn Island and the founder of the colony, Fletcher Christian, the officer who led the mutiny on the Bounty.

The first generation descendants, averaged 177.8 centimetres (minimum 5 feet 9 1/2 inches, maximum 6 feet 1/4 inch). This represents an average increase of over two inches, with the shortest male exceeding the average of his parental groups by a considerable margin. Although this striking increase has not been fully maintained in the present generation, it is still almost an inch above the parental average.

As far as the evidence goes, then, the Pitcairn experiment lends no support for the thesis that race mixture merely leads to degeneration or at best produces a breed inferior to the superior parental race. In fact, we see in this colony some support for heightened vigour, for an extended variation and for a successful issue of the mingling of two diverse strains.

— *August-September 1953*

THE SPREAD OF BUDDHIST CULTURE

by Anil de Silva

For eight miles along the Irrawaddy River and for two miles inland a forest of Buddhist pagodas and stupas extends to the horizon at Pagan in central Burma (above). Built in the 11th century, Pagan once had no fewer than 4,000 pagodas and was one of the great religious cities of Asia until reduced by the armies of Kublai Khan in 1287. Right, head and shoulders of the colossal Reclining Buddha (measuring 28 metres) that lies amid the ruins of Ayutya, Siam's ancient capital. The statue is thought to date from the 16th century.

IN THE STEPS OF THE BUDDHA

IN India, during the third century B.C. the Emperor Asoka was converted to Buddhism after a bloody war against the neighbouring Kalinga Kingdom. He then issued his famous edict which he caused to be carved on rock and stone throughout his kingdom:

"One hundred and fifty thousand people were deported, one hundred thousand people were killed, many times this number perished... Remorse fills the King friend of the Gods since he has conquered Kalinga. The conquest of an independent country means murder, death or captivity for men. All are victims of violence and death and separation from those who are dear to them. These thoughts weigh heavily on the King friend of the Gods...

"Even if the number of victims in the conquest of Kalinga were a hundred thousand times smaller, the thought of this would afflict the King friend of the Gods. Even if they were in the wrong the King friend of the Gods believes we should have been as patient as possible. The victory that is the best of all is the Victory of the Good Law (Buddhism). This text of the Law is engraved for my sons and grandchildren so that they will not dream of new victories. Let them seek real victories through the exercise of patience..."

The world in which Buddhism was born 2,500 years ago was a world of vast movements of men and ideas, much vaster than we generally imagine. In this world India was geographically, the crossroads between Western and Far Eastern civilizations. Both the great land routes entered her northern passes from the West through Persia and from the East through China and Central Asia, over the old silk caravan route.

On the maritime routes, Persian, Greek, Roman and Alexandrian ships scoured the ports of Gujerath and Konkan on the west coast, and Coimbatore, Andhra, Bengal and Ceylon in the south. India was also the port of call for Far Eastern ships going westwards, and her own ships sailed out in all directions.

Contacts between the Western world and India were continuous. The Persian Emperor Darius left his great terraced palace at Persepolis to lead an expedition into the Punjab and the Indus valley a few years before the death of Buddha in the 5th century B.C.

Alexander's expedition in the fourth century B.C., bringing with it topographers and scientists, helped to strengthen the land route kept up by the couriers of the Persian monarchs. Alexander built a port and a fleet on the Indus and his captain, Nearque, sailed down the Indus, forging a maritime route between the Indus and the Tigris. Alexander returned through Afghanistan with elephants and Indian soldiers in his army.

The whole of north-west India, Afghanistan, Gandhara (Afghanistan and Pakistan territory) and the Punjab remained for centuries under a succession of Greek princes, one of whom, Milanda (Menander), became a Buddhist. These Greek kingdoms favoured the penetration of Greek, Hellenistic and Roman culture. Greeks intermarried with Indians and these colonies formed centres of a new Greco-Roman Buddhist culture. The new culture developed rapidly under the Kushana Empire which succeeded the Greeks in the 1st century A.D. (The Kushans were nomads who

CONTINUED ON PAGE 24

Below, the Footprint of Buddha covered with sacred signs and symbols, carved at the temple city of Angkor Wat, Cambodia, in the 12th century. The Buddha is said to have been born with certain imprints on the soles of his feet and Buddhist iconographers have made great use of these signs.

Photo © Giraudon

ANIL DE SILVA *has written extensively on the art and literature of Asia, particularly Buddhist painting and sculpture.*

Photo © J. Lavaud

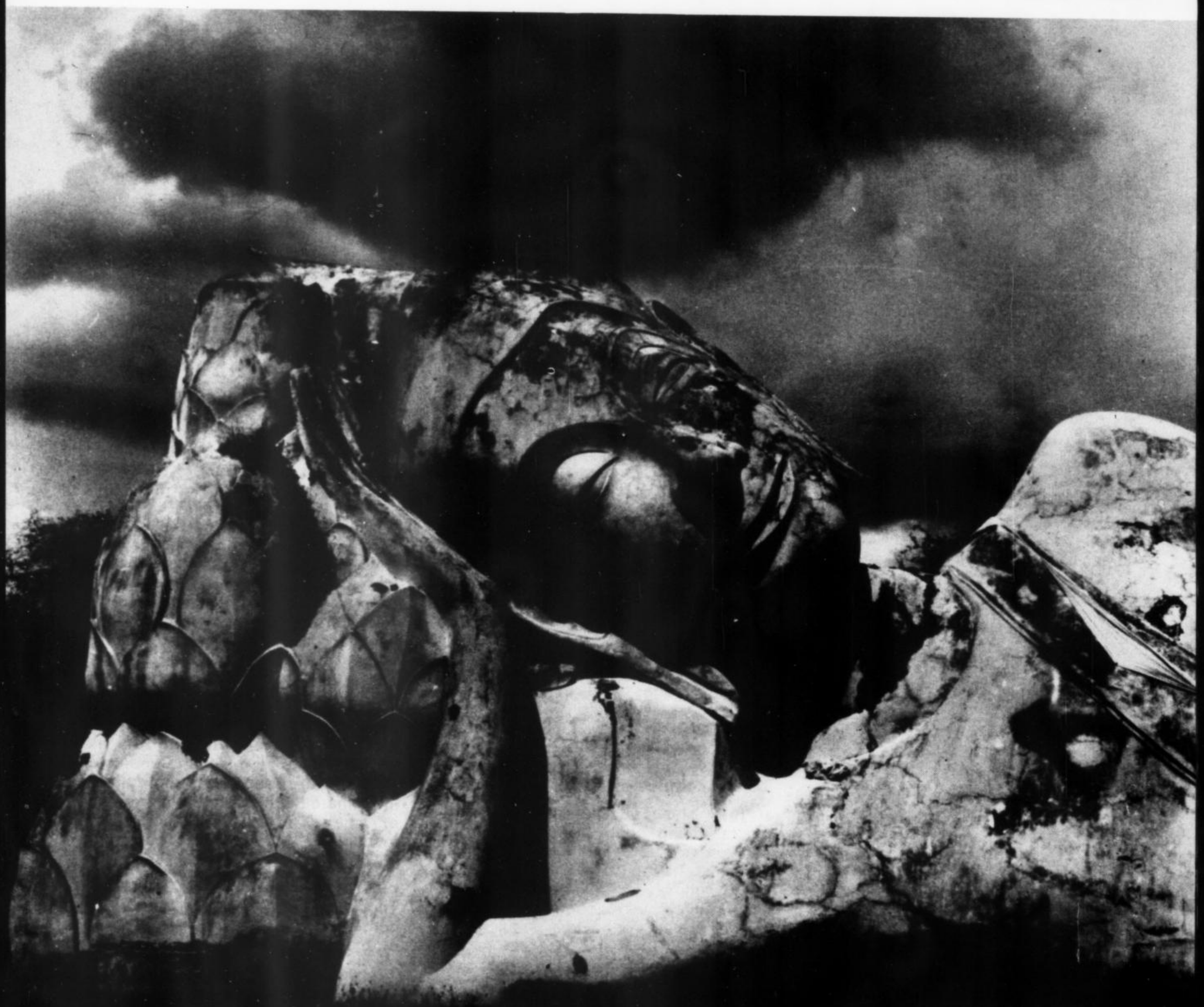

Photo © Paul Almasy, Paris

invaded India from China and Central Asia and whose emperors were converted to Buddhism).

More important than wars and conquests was the long period of friendship between Alexander's successors, the Seleucid kings in Persia and the Mauryan kings in north India, whose palace was modelled on that of Darius at Persepolis, Persia. Ambassadors were exchanged and foreign merchants thronged the capital Pataliputra (today Patna, capital of Bihar province, north-east India). The Emperor Asoka married a Greek princess and sent his missionaries both to the East and the West. His emissaries to the West, carrying the message of Buddha, reached Persia, Egypt, Macedonia, Cyrenaica and north-west Greece.

The Roman historian Pliny tells us that Rome bought 50 million sesterces worth of merchandise from India every year: cotton from Malwa, lacquer and nard from Pataliputra, indigo, spices and precious stones from Konkan, jades, ivories, silk and elephants which the Romans used in large numbers for their army and circus. Roman coins of gold have been found in the north-west and along the coast of south India at Cannanore, Coimbatore and Mahabalipurum with effigies of Augustus, Caracalla, Claudius, Theodore and Constantine. A Roman-Asian artist named Titus painted Buddhist frescoes at Miran in Central Asia. Alexandrine merchants aided Buddhist convents at Nasik and Junnar near Bombay.

History gives us only a glimpse of the vast movement of men at this time: recruits in various armies (Indian archers excelled in the Persian army); craftsmen, metal workers, ivory carvers (Indian ivories have been found in Pompeii); weavers, jewellers, sculptors and ceramists were sought after at any price and protected by merchants and princes.

CENTRAL Asia had two routes through the desert: a northern one and a southern one. They met at Tun Huang in north-west China. These were the principle arteries of Buddhist expansion in Central Asia and China and all became powerful centres of Buddhist culture. Thousands of grottos were excavated and open-air constructions were built. At Kizil alone thousands of grottos were cut out, painted and carved by artisans from the Middle East, India and China.

Hsuan Tsang, the famous Chinese scholar who made his pilgrimage to India by the northern route in the 7th century A.D., has left an unforgettable account of his journey through burning deserts and snow-clad passes.

Historians also speak of the charm of the women of Kutsha and record that musicians and dancers from Kutsha were seen at the Imperial Chinese festivals, dressed in crimson silk turbans. The titles of their songs have been preserved: "The Meeting of the Seventh Evening," "The Woman of Jade Takes Round the Cup," and "The Battle of Flowers."

The frescoes of Kutsha, Kizil and Kumtura show us the splendid cavaliers—those who, Hsuan Tsang tells us, escorted him on his way, for many of these paintings were made by contemporaries of Hsuan Tsang.

They show cavaliers wearing long boots, riding coats of silk falling to the knees and taken in at the waist with metal belts. Their tunics of blue, grey, white and olive green were embroidered with pearls, lined and bordered with fur. Their reddish hair was caught up with ribbons at the neck. They must have formed a glorious sight with their coloured and gilded banners and standards, sculptured and painted with heraldic animals like the tiger and the dragon. Hsuan Tsang returned to China laden with manuscripts and images of the Buddha.

Bamiyan in Afghanistan was the halting place for caravans either going to or coming from the difficult passes of the Hindu Kush which barred the way into India. Into the façade of the great cliff of Bamiyan, cave sanctuaries with colossal Buddhas were carved and painted, two of these images reaching 173 and 120 feet in height. Merchants paid craftsmen and artists to paint and carve statues as thank-offerings for a safe journey.

Tun Huang at the other end of the route was developed with the help of merchants and royal benefactors, for the Wei, T'ang and Sung dynasties in China all contributed to the creation of one of the most extraordinary monuments of Buddhist culture.

Among the hundreds of cave temples at Tun Huang, the Cave of the Thousand Buddhas, sealed up for centuries, housed priceless treasures of manuscripts and paintings on silk.

The first mention of Buddhism in China is in 65 A.D. when the Han prince, Tch'ou protected a small Buddhist community at Lo-yang. The translation of Buddhist texts from Sanskrit and Pali into Chinese was officially encouraged by the Kushna Empire in India (30-224 A.D.). Chinese travellers, merchants, imperial envoys and pilgrims came to India by sea. In fact it is to Chinese historians that we owe the only written accounts

Photo © Magnum - Bischof

The sanctuaries in the Horyuji monastery at Nara, near Kyoto, are renowned as treasure houses of Buddhist art. In the famous Five-Storeyed Pagoda, more than 80 clay figures made in the 8th century (the oldest dated works of clay sculpture in Japan) present four episodes from the life of Buddha. Here, saints, disciples and ascetics lament the passing of the Enlightened One.

of these early kingdoms in south-east Asia.

The spread of Buddhism throughout Asia came in several waves emanating from India from the first century A.D. Bronze statues of the time have been unearthed from the jungles of Annam, Borneo and Celebes. Buddhist culture apparently superimposed itself on the whole of south-east Asia. However each region retained much of its own personality and character.

In the 8th century A.D. Buddhist art began to mature and flower in these countries, gaining in movement and vigour when local tradition dominated. We see this clearly at Borobudur (Java) in whose 1,400 panels and 504 statues of the Buddha the Javanese pattern of composition, harmony and repose are blended with the Indian style of art. Later Javanese art threw off this influence and asserted its own national characteristics.

Eventually there were large monasteries and universities in all the Buddhist countries of south-east Asia, Japan and Korea. Pilgrims in their thousands from all over Asia thronged the great Buddhist universities of Takila in Pakistan and Nalanda in India. Hostels were built by the kings of Ceylon and Java to house the students and pilgrims from their countries at Nalanda and at Bodh Gaya in the Indian state of Bihar, where Buddha attained enlightenment under the Bodhi tree.

Many of the ships leaving Bengal and the southern India ports carried pilgrims and missionaries and, in addition to the spices, precious stones, muslins and silks in their holds, they bore statues of the Buddha made in the busy centres of Mathura and Nalanda.

THE coming of Buddhism, coinciding as it did with increased trade and intercourse between Asian countries, resulted in a period of intense intellectual life. The message of the brotherhood of men—"No one is a Brahmin or an outcast by birth, but one becomes a Brahmin or an outcast by one's actions" (Vasala Sutra)—was like rain falling on parched earth. It stimulated a resurgence of popular feeling just as Christ's message did in Rome in early Christian times.

The richly human content of the Buddhist message was the spiritual basis of an art which overrode the frontiers of artistic expression, revitalized local traditions, making them truly Buddhist and at the same time freed expressions of national character. It was a message of hope. It was a message of peace. And these two important factors helped the development and maturity of a noble art that has enriched the artistic traditions of the world.

— *June 1956*

THE CHALLENGE OF THE SPACESHIP

By Arthur C. Clarke

This is a historic article. It was written ten years before the launching of the world's first artificial satellite in October 1957, and shows the remarkable foresight of this world-renowned science writer. Arthur C. Clarke, former chairman of the British Interplanetary Society, won the Unesco Kalinga Prize for the Popularization of Science, in 1962.

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AN historian of the twenty-first century, looking back past our own age to the beginnings of human civilization, will be conscious of four great turning points which mark the end of one era and the dawn of a new and totally different mode of life.

Two of these events are lost, probably forever, in the primeval night before history began. The invention of agriculture led to the founding of settled communities and gave man the leisure and social intercourse without which progress is impossible. The taming of fire made him virtually independent of climate and, most important of all, led to the working of metals and so set him upon the road of technological development—that road which was to lead, centuries later, to the steam engine, the Industrial Revolution, and the age of steel and petrol and surface transportation through which we are now passing.

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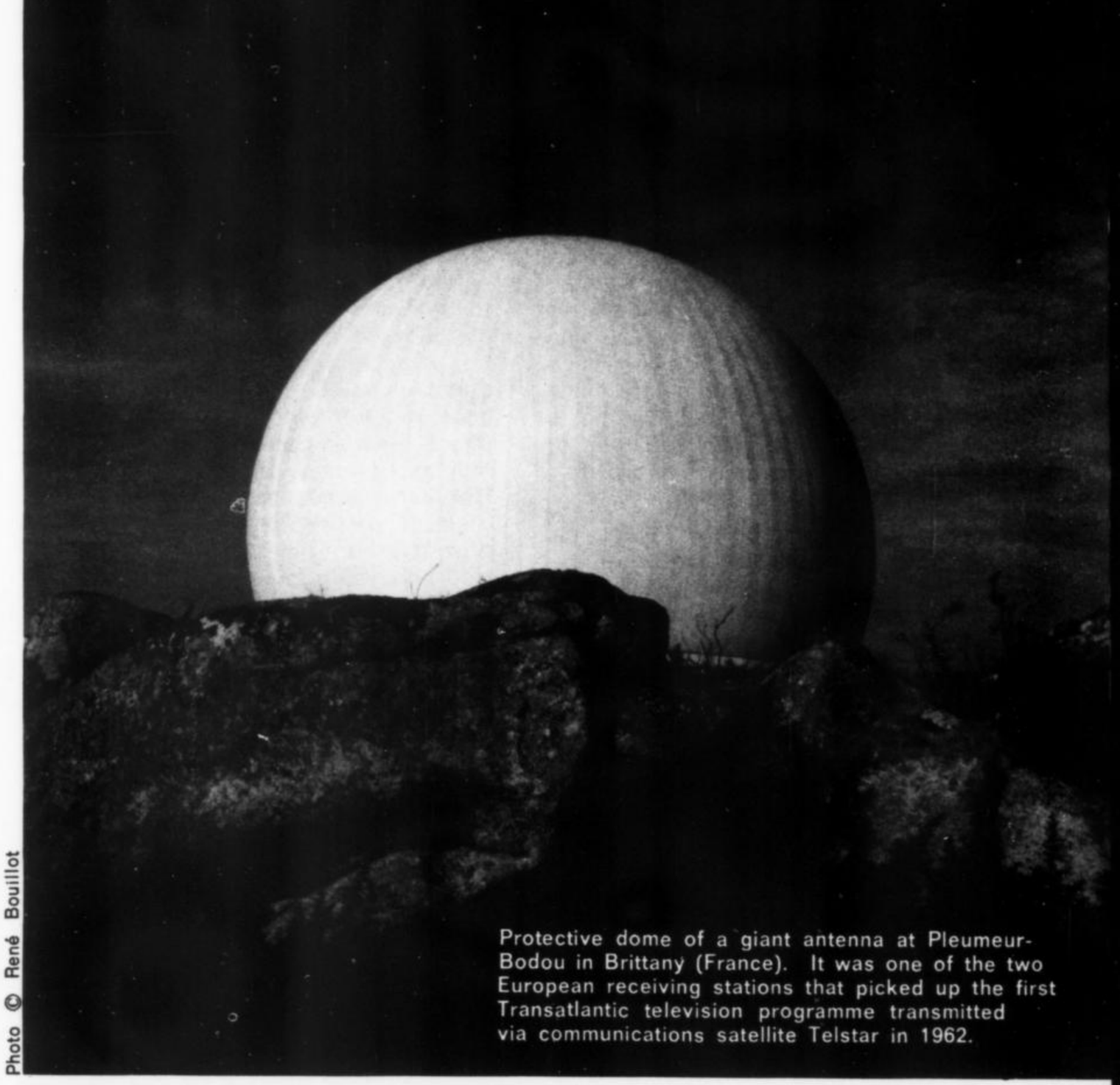

Photo © René Bouillot

Protective dome of a giant antenna at Pleumeur-Bodou in Brittany (France). It was one of the two European receiving stations that picked up the first Transatlantic television programme transmitted via communications satellite Telstar in 1962.

The third revolution began, as all the world knows, in a squash-court in Chicago on December 2, 1942, when the first self-sustaining nuclear reaction was started by man. We are still too close to that cataclysmic event to see it in its true perspective, but we know that it will change our world, for better or for worse, almost beyond recognition. And we know too that it is linked with the fourth and in some ways greatest change of all—the crossing of space and the exploration of the other planets.

The first spaceships capable of reaching another world may still lie half a century ahead, but the giant rocket is already with us and will soon be carrying men to the limits of the atmosphere and beyond. Nor will it be many years before a guided missile reaches the moon and blazes the trail along which men will travel a generation later.

An attempt to construct a philosophy of astronautics is therefore far from premature: it is, if anything, a little belated. In the last few years we have seen the political and ethical chaos produced when a great technical development comes into a world which is unprepared for it.

If our civilization is to have a future, then we must see that it does not repeat its earlier mistakes. I do not suggest—as some have done—that lawyers need start worrying immediately about the ownership of the moon, but the ownership of space will soon be a matter of acute practical importance. This problem will be of grave concern in another decade, when long-range research projectiles begin to travel far outside the atmosphere with a supreme indifference to the geography beneath them.

THERE was a time—not long ago—when those who advocated interplanetary travel were always being asked, "How?". It is amusing to recall that in those days—which now seem so remote—there were many people who refused to believe that a rocket could work in a vacuum or would ever be able to rise more than a few miles from the earth.

Today, the power of the rocket has been demonstrated, only too thoroughly. "How" is a question one seldom hears in discussions concerning spaceflight: the commoner query is now "Why?" And it is much more difficult to answer, for it involves the motives underlying all human conduct.

The urge to explore, to discover, to "follow knowledge like a sinking star", is a primary human impulse which needs, and can receive, no further justification than its own existence. The search for knowledge, said a modern Chinese philosopher, is a form of play. If this be true, then the spaceship, when it comes, will be the ultimate toy that may lead mankind from its cloistered nursery out into the playground of the stars.

It is not hard to think of entirely valid "practical" reasons why one should wish to cross space. There is no doubt that eventually sheer necessity would bring about the conquest of the other planets. I do not believe that it is possible to have a virile, steadily-advancing culture limited to a single world, and taking the long-term view, we know that our earth will one day become uninhabitable.

In his book, *The Birth and Death of the Sun*, the physicist George Gamow points out that before its evolution has finished, our sun will become 100 times as luminous as it is today. I am glad to see that he draws the obvious conclusion and visualizes the migration of humanity to the outer planets before our earth's oceans have begun to boil.

But the human race will not wait until it is kicked out. Long before the sun's radiation has shown any measurable increase, man will have explored all the solar system and, like a cautious bather testing the temperature of the sea, will be making breathless little forays into the abyss which separates him from the stars.

To support my argument, I now have to develop some sort of time-scale. I do this with much reluctance, since prophecy is a dangerous and thankless business, frequently fatal to those who practise it. We have, however, learned by past experience that even the most extravagant forecast seldom overtakes the truth.

The advances in rocket research since the 1940s have been phenomenal, but they have merely laid the foundations for what is still to come. During the next decade, the techniques necessary to send small, radio-controlled rockets to the moon will become available.

There is no reason why such flights should not take place by 1960. The public, not realizing the problems still to be faced, will expect human beings to follow in a very short time. It will be disappointed. During the subsequent years there will be innumerable short-range flights beyond the atmosphere by man-carrying ships reaching heights of a few thousand kilometres. But if we have to rely on chemical fuels, it may require at least 20 years of further experimenting before the first true spaceship lands on the moon and returns to earth.

That brings us to the late 1970s. Any chemically fuelled spaceships will be unwieldy, fabulously expensive machines with fuel consumptions measured by the thousand tons for a single voyage. Not more than one or two countries will be able to build them, and they will be of scientific value only. There will be no question, for a very long time, of colonization or of voyages to the other planets. But—and it is a very large but—any prophet would indeed be rash if he based his predictions upon the use of chemical fuels alone.

Here, as in other fields, the great question-mark is atomic energy. In theory, a few kilogrammes of uranium could take a ship weighing 1,000 tons to the moon and back. In practice, we have a very long way to go before this can be done.

The fact that it is not possible for any spaceship to carry enough fuel for a voyage to another planet *and back* has long focused attention on what have been called "orbital techniques". Once a rocket is above the atmosphere and therefore no longer subject to air resistance, it becomes theoretically possible for it to turn itself into a sort of "artificial moon". It could wait effortlessly until "tanker" rockets were sent up to refuel it: then, when its supplies had been replenished, it could continue on its way.

In this manner any interplanetary journey can be broken down into a number of stages, with refuelling between them, and this procedure is believed to be the key to space-flight. It seems likely that we may use the present-day "chemical" rockets to climb up from earth into the refuelling orbit, and then continue from there using atomic or "ion" rockets.

ATOMIC power is hardly likely to advance the conquest of space by more than 10 years, but it may make it practical almost from the beginning which otherwise would certainly not have been the case. What is equally important, it will mean that the whole solar system, and not merely the moon, will be immediately accessible to man.

It requires little more power to reach the planets than it does to go to the moon, but the most economical voyages involve months or event years of free "coasting" along orbits curving halfway round the sun. With atomic power these journeys could be cut to a fraction of the time. For example, the "cheapest" journey to Mars—as far as fuel is concerned—lasts 258 days. With an atomic ship, travelling by a more direct route at quite a moderate speed, it need take only a few weeks.

The last quarter of this century will be an age of exploration such as man has never before known. By the year 2000 most of the major bodies in the solar system will probably have been reached, but it will take centuries to examine them all in any detail.

Those who seem to think that the moon is the goal of interplanetary travel should remember that the solar system contains eight other planets, at least 30 moons, and some thousands of asteroids. The total area of the major bodies is about 250 times that of earth, though the four giant planets probably do not possess stable surfaces on which landings could be made. Nevertheless, that still leaves an area 10 times as great as all the land surface of the earth.

This, then, is the future which lies

before us, if our civilization survives the diseases of its childhood. It is a future which some may find terrifiying, as no doubt our ancestors found the hostile emptiness of the great oceans. But the men who built our world crossed those oceans and overcame those fears. If we fail before the same test, our race will have begun its slide into decadence.

When the great explorers of the past set sail into the unknown they said goodbye for years to their homes and everything they knew. Our children will face no such loneliness. When they are among the outermost planets, when the earth is lost in the glare of the sun and the sun itself is no more than the brightest of the stars, they will still be able to hear its voice and to send their own words in a few hours back to the world of men.

The most obvious and direct result of the crossing of space will be a revolution in almost all branches of science. One can never predict the outcome of any scientific investigation and the greatest discoveries—the ones which will most influence human life—may come from sciences as yet unborn.

Astronomy and physics will, of course, be the fields of knowledge most immediately affected. In both these sciences there are whole areas where research has come to a dead end, or has never even started, because our terrestrial environment makes it impossible.

The atmosphere, which on a clear night looks so transparent, is in reality a coloured filter blocking all rays beyond the ultra-violet.

An observatory on the moon, working with quite small instruments, would be many times as effective as one on earth. Far greater magnifications could be employed, and far longer exposures used. In addition, the low gravity would make relatively simple the building of larger telescopes than have ever been constructed on this planet.

In physics and chemistry, access to vacua of unlimited extent will open up quite new fields of investigation. The electronic scientist may well look forward to the day when he can build radio tubes a kilometre long, if he wishes, merely by setting up his electrodes in the open! We may learn more about gravity when we can escape partially or wholly from its influence.

The prospect of building stations in space, circling the earth like tiny moons in orbits beyond the atmosphere, is one that has a peculiar fascination. Meteorological observatories in space could see at a glance the weather over half the planet, could watch in detail the movement of storms and rain areas. Indeed, really accurate forecasting may have to wait until meteorologists get out into space.

The space station has one other application of the greatest importance,

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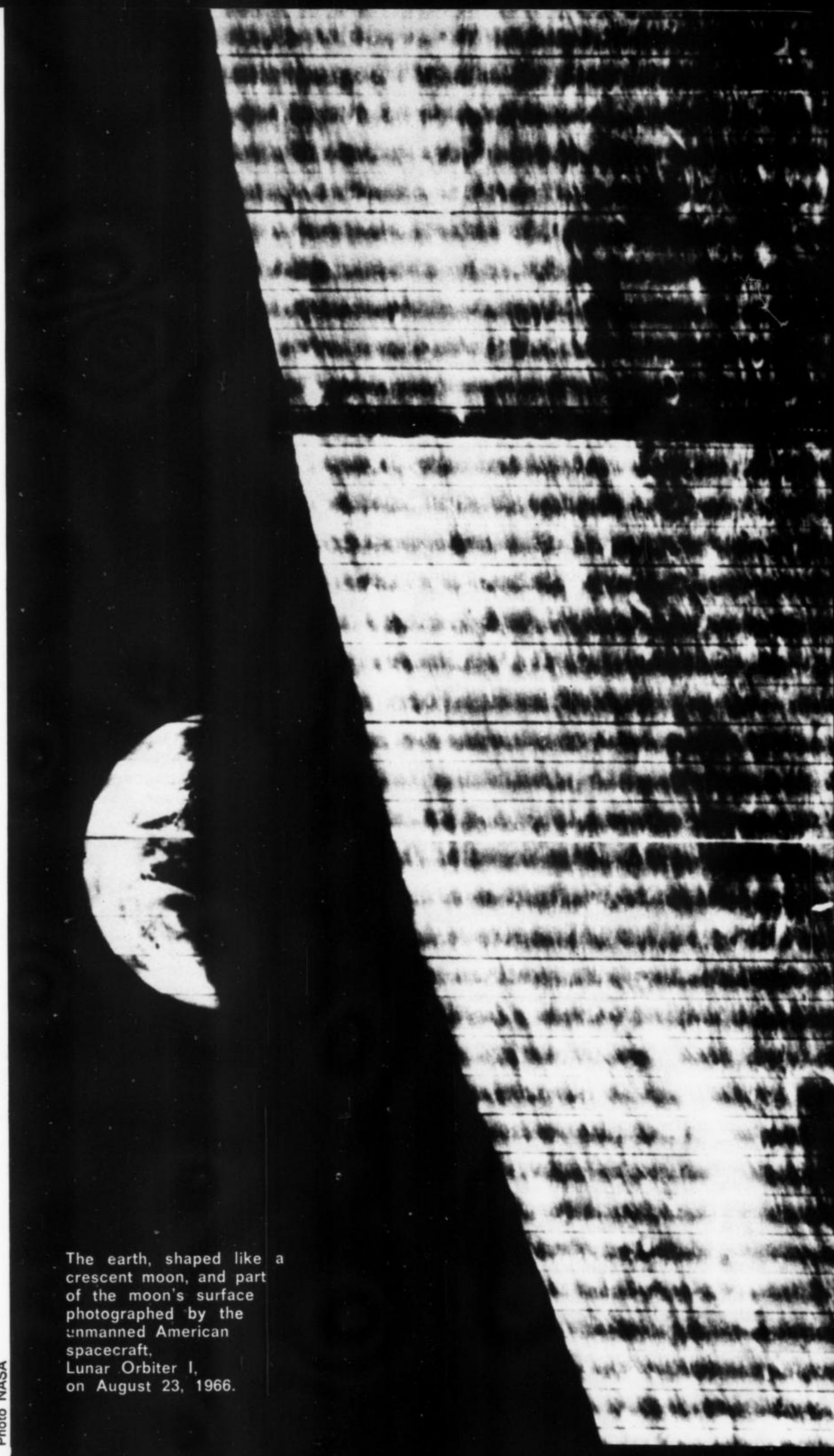

The earth, shaped like a crescent moon, and part of the moon's surface photographed by the unmanned American spacecraft, Lunar Orbiter I, on August 23, 1966.

Photo NASA

LUNAR INTERNATIONAL LABORATORY

The moon's great potential for science can best be realized if investigations are conducted as an international enterprise and in an international laboratory. This idea gave rise to the Lunar International Laboratory Committee of the International Academy of Astronautics. The committee came into being in August 1960 when the concept of a lunar international laboratory (LIL) was put forward at Stockholm during the 11th Congress of the International Astronautical Federation. As Dr. Frank J. Malina, Chairman of the LIL Committee, has stated: "Just about every branch of science will find the moon, with its unique environmental conditions—no atmosphere, a gravity only 1/6th that of the earth, very weak or non-existent magnetic field—a great laboratory for a host of experiments and observations essentially impossible to perform on earth." The foundations for a Lunar International Laboratory may well have been laid on December 13, 1963 when the General Assembly of the United Nations unanimously declared: "The exploration and use of outer space shall be carried on for the benefit and in the interests of all mankind."

— *May 1966*

for it provides perhaps the only means of world-wide television broadcasting. Three relay stations circling the earth could provide a steady, reliable service from pole to pole with no more power output than that of a single present-day station.

However, the first direct results of astronautics may be less important than its indirect consequences. This has proved true in the past of many great scientific achievements. Copernican astronomy, Darwin's theory of evolution, Freudian psychology—these had few immediate practical results, but their effect on human thought was tremendous. We may expect the same of astronautics.

With the expansion of the world's mental horizons may come one of the greatest outbursts of creative activity ever known. The parallel with the Renaissance, with its great flowering of the arts and sciences, is very suggestive. Interplanetary travel is now the only form of "conquest and empire" compatible with civilization. Without it, the human mind, compelled to circle forever in its planetary goldfish bowl, must eventually stagnate.

We all know the narrow, limited type of mind which is interested in nothing beyond its town or village, and bases its judgments on parochial standards. We are slowly—perhaps too slowly—evolving from that mentality towards a world outlook.

Few things will do more to accelerate that evolution than the conquest of space. It is not easy to see how the more extreme forms of nationalism can long survive once men see the earth in its true perspective as a single small globe among the stars.

THE solar system is rather a large place, though whether it will be large enough for so quarrelsome an animal as *Homo sapiens* remains to be seen. But it is surely reasonable to hope that the crossing of space will have a considerable effect in reducing the psychological pressures and tensions of our present world.

Much depends, of course, on the habitability of the other planets. It is not likely that very large populations will, at least for many centuries, be able to subsist outside the earth. There may be no worlds in the solar system upon which men can live without mechanical aids, and some of the greatest achievements of future engineering will be concerned with shaping hostile environments to human needs.

We must not, however, commit the too common mistake of equating mere physical expansion, or even increasing scientific knowledge, with "progress"—however that may be defined. Only little minds are impressed by sheer size and number. There would be no virtue in possessing the universe if it brought neither wisdom nor happiness. Yet possess it we must, at least in spirit, if we are ever to answer the questions that men have asked in vain since history began.

Every thoughtful man has asked himself: is our race the only intelligence, or are there other, perhaps far higher, forms of life elsewhere? There can be few questions more important than this, for on its outcome may depend all philosophy—yes, and all religion too.

The first discovery of planets revolving round other suns, which was made in the United States in 1942, has changed all ideas of the plurality of worlds. Planets are far commoner than we had believed: there may be thousands of millions in the galaxy alone. Few men today would care to argue that the earth must be the only abode of life in the whole of space.

It is true—it is even likely—that we may encounter no other intelligence in the solar system. That contact may have to wait for the day, perhaps ages hence, when we can reach the stars. But sooner or later it must come.

If the universe does hold species greatly in advance of our own, then why have they never visited the earth? There is one very simple answer to this question. Let us suppose that such races exist: let us even suppose that, never having heard of Einstein, they can pass from end to end of the galaxy as quickly as they wish...

That will help them less than one might think. In 10 minutes, a man may walk along a beach—but in his whole lifetime he could not examine every grain of sand upon it. For all that we know, there may be fleets of survey ships diligently charting and recharting the universe. Even making the most optimistic assumptions, they could scarcely have visited our world in the few thousand years of recorded history.

The desire to give a comprehensive picture of the outcome of astronautics has compelled me to range—not unwillingly—over an enormous field. However, I do not wish anyone to think that the possibilities we have been discussing need come in this century, or the next, or the next. ... Yet any of them may arise, at any time, as soon as the first ships begin to leave the earth. Man's first contact with other intelligent races may lie as far away in time as the building of the Pyramids—or it may be as near as the discovery of X-rays.

Of this, at least, we may be fairly certain: barring accidents—the most obvious of which I need not specify—the exploration of the planets will be in full swing as this century draws to its close. To examine them in any detail, and to exploit their possibilities fully, will take hundreds of years. But man being what he is, when his first ship circles down into the frozen wastes of Pluto, his mind will already be bridging the gulf still lying between him and the stars.

— *November 1957*

MY FIRST STEPS IN SPACE

By Aleksei Leonov

March 18, 1965 is a date that will be remembered in the history of astronautics. On that day, Aleksei Leonov became the first man to leave a space vehicle and walk in outer space. This article was specially written for the "Unesco Courier" by Aleksei Leonov himself and published in our June 1965 issue.

ONLY the unforgettable moments at the take-off and the recollection of the long months of flight training forced me to believe in the reality of the scene that unfolded before my eyes as I viewed the spaceship while I floated through the vacuum of space. Voskhod II sailed with an awesome majesty, its antennae—like the whiskers of some monster—probing the emptiness of space. Its portholes looked like enormous eyes contemplating fixedly my every movement.

Before me—blackness: an inky-black sky studded with stars that glowed but did not twinkle; they seemed immobilized. Nor did the sun look the same as when seen from Earth. It had no aureole or corona; it resembled a huge incandescent disc that seemed embedded in the velvet black of the sky of outer space.

Below me our sky-blue planet drifted by. It did not look round but completely flat, like a giant physical map. Only the curvature of the horizon showed that it was round.

Four years ago my countryman Yuri Gagarin, spent only 108 minutes in space. Today manned spacecraft make flights lasting several days.

In the future, space vehicles will be spending more and more time in orbit, and there will probably be several in flight at the same time. The number of crew members will also increase. Scientists are already studying the problem of setting up permanent stations in orbit. Man will naturally want to explore other planets.

But if this is to be possible man must learn to assemble heavy spacecraft directly in orbit. He must be able to pick up the crews of orbiting space laboratories, move from one ship to another in cases of emergency

Photo © APN

Leonov floating in space. Brilliant rays of sunlight have struck the camera lens, tracing strange, ghostly patterns of light.

or simply maintain contact with fellow human beings during interplanetary flight.

For this to be feasible, man had to learn to leave his spacecraft and find the best way of doing so. But the question arose—was it possible for man to leave a space vessel and survive? Could he carry out the assembly work that is indispensable to the rendezvous of spacecraft?

Pavel Belyayev, commander of Voskhod II, and I had the good fortune of being chosen for the space flight of March 18 that aimed to give the first answers to these questions.

Commander Belyayev started preparing me for my exit from the craft when we were over Kamchatka. He helped me to put on the cylinder containing my air supply. I checked the connexions linking my breathing mixture to the spacesuit. Belyayev opened the inner door of the air lock. Together we fastened to my spacesuit the tether-cable that would keep me attached to the ship. I unstrapped myself from the seat and floated into the chamber of the air lock.

I gave a hand signal to the commander. The inner door closed behind me. Belyayev began to empty the chamber of air in order to equalize the pressure with that outside the ship. I could feel this happening from the way my spacesuit became inflated.

I made my way forward in the lock toward the exit and poked a bit of my head out. We were over the Mediterranean. I was in a hurry to leave the lock, get a look at the Earth from space and see the ship.

Belyayev signalled me to cast off. In my impatience to get out, I pushed off too vigorously from the edge of the air lock and left the ship like a cork popping from a bottle. Below—directly underneath me—was the Crimea. I saw the Black Sea, the blue swath of the bay near Novorossisk, the cloud-capped mountains of the Caucasus.

I found myself spinning and was powerless to control it. I had had the same experience when Belyayev and I were practising in the aeroplane-laboratory the technique of exit and re-entry under conditions of weightlessness. So I did nothing about it. I merely waited for the kinking of the tether to slow down the rotations. And, as I expected, the angular momentum decreased little by little. I was, of course, still turning on a transversal axis. I could have checked this by grabbing hold of the tether, but I preferred to keep on rolling because this enabled me to see better.

Below, the majestic green mountain ranges of the south of the U.S.S.R. floated by. I recognized the Volga; then I saw the Urals, and the mighty Siberian rivers, the Ob and the Yenisei.

I removed the lens guard of the motion picture camera that was to photograph all of my movements in the vacuum of space. It was mounted on a special stand near the edge of the air lock. A moment later, to pull myself foward, I tugged rather vigorously at the tether and found the ship bearing down on me. I warded it off with my hands, otherwise I might have knocked my pressurized helmet against its hull. By stretching out my arms I was able to break the impact. It is clear that once man has adapted himself to the extraordinary conditions in space, he can move about in a co-ordinated and precise manner.

While in space, I was constantly in telephonic contact with Pavel Belyayev and with Earth. I spoke to Yuri Gagarin who was on duty in the control room of the spaceport.

While over the Yenisei, Commander Belyayev gave me the signal to re-enter the ship. I was feeling wonderful and was in no hurry to leave open space. So I pushed off once again from the edge of the air lock as I wanted to find out what produced the angular movements immediately following the push-off. It turned out that these movements were caused by even the slightest displacement in the angle of the force of thrust in relation to the axis of the space capsule.

I then carried out Commander Belyayev's order and began to approach the ship. On the way I picked up the camera from its support.

I wanted to enter the air lock directly, but this was far from easy. The inflated spacesuit constricted my movements. I had to use all of my strength to re-enter the air lock. But before long I was back in the cabin alongside Pavel Belyayev.

So ended the experiment in which a man climbed out of a capsule into space. I had spent twenty minutes outside the cabin. During this time, Voskhod II had gone far from the Mediterranean over which we had been travelling when I first went into the air lock; we were now approaching the Pacific Ocean.

— *June 1965*

Photo © Musée de l'Homme, Paris

Ball games were highly developed in pre-Columbian Central America. Above and right, two small Tarascan ceramics depicting ball players reflect the popularity of such games. Artists in these ancient civilizations displayed extraordinary skill and imagination in modelling innumerable figurines which record the myriad aspects of everyday life.

HUMOUR AND MAJESTY OF MEXICAN ART

— June 1952
— December 1965

This head with its high pointed head-dress is a masterpiece of pre-Columbian art which flowered on the coast of the Gulf of Mexico over seven centuries ago. Carved in basalt, it is 38 cm. (15 in.) high, and may have served as an architectural decoration in the Totonic civilization.

Photos © Gisèle Freund, Paris

Joy and sorrow are graphically captured on these two tiny statues produced by the pre-Columbian Indians of Mexico. Left, "Smiling Mask" of the Totonac civilization; below, "Eyes with Tears," by a Huastec Indian artist. Both show a high degree of artistic skill and convey the same sense of realism.

Photos © Gisèle Freund, Paris

VERNACULAR LANGUAGES IN CHANGING AFRICA

by Pathé Diagne

WE have become so used to talking about Africa's countless languages that we have lost sight of the fact that Africa is, after all, a whole continent. A more than cursory examination of the languages of this continent reveals first, that the number has been vastly exaggerated, and second, that the situation is hardly different elsewhere. Europe possesses dozens of languages and dialects; and "Standard African" is as much of a misnomer as "Universal European" would be. French and Italian exist as separate languages, so why not Swahili, Hausa and Yoruba?

Despite the existence of local variations, the number of linguistic zones in Africa is really quite small. Within each zone there is a linguistic unity which is not only historical but also a living fact.

Let us take the case of the zone comprising the so-called Bantu languages. Here we find not various distinct and separate languages but different dialects of the same language. The common features are so extensive that one can pass quite easily from one dialect to the other.

In the Congo practically everyone is multilingual. In addition to their local dialects, the Lari, the Vili, the Bateke, the Bangala and the Kikongo all speak Lingala, Monokotuba or some other language.

From the number of dialects the Vili of Pointe-Noire understand one might assume that they have a special aptitude for foreign languages. A Vili, for example, can easily understand or get along in Lari, Teke, Swahili and Chiluba. This is simply explained by the fact that they are all dialectal variations of one and the same language. The slight differences in these dialects is evident from the following renditions for the word TO EAT: KULIA in Vili; KUDIA in Kikongo; KUDIA in Lari; KOLIA in Lingala; KULIA in Swahili.

As can be seen, the differences are merely a matter of one consonant or vowel, and serve to illustrate the idea that the whole Bantu linguistic zone could today be unified around one of these dialects. This unification would affect some 100 million persons.

What is true of the Bantu linguistic zone also applies to other parts of Africa. In the Sudanese belt of countries stretching across Africa just below the Sahara, the same phenomenon can be observed with regard to Hausa, the Mandingo language group (Bambara, Dioula, Malinke), the Akan Baoule languages of Ghana and the Ivory Coast, and the Fulani (or Pular) languages.

All over the world a process of linguistic unification is now under way. In Africa the same thing is happening. Differences in speech are being worn down, and are giving way to a limited number of major languages of communication. This is occurring as a result of various factors. Urbanization, the cultural renascence and the development of great trading centres have enabled a few languages to unify whole areas.

This has completely transformed the linguistic map of tropical Africa so that many of the splinter dialects of the past are now being absorbed by about a dozen dynamic, hard-core languages today spreading across the continent.

Most of these languages are now used by groups of 1 million to 12 million persons. But some are spoken by over 50 million people. For example, there is the Bantu group, spoken by 100 million people; Swahili, spoken by over 50 million persons in most of East Africa (Kenya, Uganda, Tanzania, Zambia and the Democratic Republic of the Congo); the Lingala-Kikongo-Monokotuba language family, spoken by about 30 million persons over most of Central Africa (Central African Re-

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public, Congo-Brazzaville, Cameroon as well as the Democratic Republic of the Congo).

The establishment of a common language for those who speak Swahili, Lingala-Kikongo-Monokotuba, or even Shango and certain Bantu dialects of South Africa and the Cameroon, is a task that could well be accomplished within the reasonable future.

The languages of West Africa are more varied. Here, Hausa, spoken by some 40 million people in Nigeria, Niger and Chad, could become a unifying element for a vast area of Africa.

Yoruba (Nigeria), Malinke - Dioula (Eastern Senegal, Mali, Upper Volta, Ivory Coast, Niger), Fulani (Senegal, Mali, Guinea, Upper Volta, Niger, Nigeria), and Arabic are all linguistic groups spoken by from 10 to 15 million people.

Tamashek (Mauritania, Mali, Niger), Ibo (Nigeria), Akan-Baoule-Bulu-Fang (Ghana, Ivory Coast), Fon-Ewe-Mina (Togo, Dahomey, Ghana), More (Upper Volta), Wolof (Senegal), Sarakhule (Mali, Mauritania, Senegal), Kanuri (Nigeria, Niger, Chad), and Djerma-Songhoi (Mali, Niger) also form linguistic areas in process of unification and are spoken by 1 to 5 million people.

Thus we see that a veritable pyramid of languages exists in West Africa, with several languages spoken in the same country—in Nigeria, for instance, Hausa, Ibo, Yoruba and Kanuri are all spoken.

But it is clear that language unification, not dispersal, is the dominant factor in Africa today.

Efforts to try to adapt African languages to modern change have been in progress for many many years. These were given new impetus with the establishment of institutions of European origin.

In 1820, a French schoolteacher set up West Africa's first secular, bilingual school at St. Louis, Senegal, where both Wolof and French were taught. This pioneer attempt was followed by the missionaries who first used African languages to spread the Gospel and then gradually introduced them for the teaching of a few new techniques in agriculture and the crafts.

The bilingual school in the Congo was the outcome of this development. In the countries under British rule, a similar approach, based on the principle of "native administration", helped the spread of African languages. The status and influence of these languages can be observed today in the Democratic Republic of the Congo, Uganda and Tanzania. These countries, with a literacy rate of 45 per cent, have been able to establish an excellent political, social and technical infrastructure by using African languages for newspapers, school books and other publications.

The interesting features here are the new possibilities thus opened. The development of a script in Swahili hastened the stabilization of the language and its literary growth which had begun long before colonization, as attested by the *Kilwa* dating from the 17th century as well as an abundance of other great works of great antiquity.

This is equally true of other African languages, particularly those of West Africa, where Fulani and Wolof literature, Hausa works (those by Dan Fodio are an outstanding example) and the writings of the Kanuri and Dendi chroniclers bear comparison with Swahili. Other languages like Lingala or Chiluba are entering the writing stage, thanks chiefly to contemporary efforts.

THE adaptation of African languages to modern change is not yet very far advanced. In this sense most of them have not yet become languages of advanced scientific knowledge or vehicles of modern literature, reflecting either in original creative works or translations from non-African languages, the intellectual ferment of contemporary thought.

Although many attempts have been made along these lines, they are mainly isolated cases. Nevertheless, a number of notable examples by outstanding African thinkers can be cited.

The Senegalese writer, C. Anta Diop, has played a pioneer rôle here. The second part of his *Nations Nègres* contains a series of chapters which illustrate how Wolof can be adapted to modern scientific writing. Anta Diop chose literary as well as scientific themes and produced translations in his native tongue of extraordinary precision and clarity. His rendering into Wolof of Einstein's Theory of Relativity as interpreted and explained by the French scientist Langevin, is superb.

He also offers us translations of poems and excerpts of plays from French literature that retain all the exquisite beauty of the original. The terminology of modern mathematics and physics which he uses opens the way for elaboration of a modern scientific culture in the Wolof language.

Wolof, it is true, is a language with a long literary tradition. C. Anta Diop makes this abundantly clear in his book with a judicious choice of texts. Nevertheless what he has done for Wolof can be done for any language, African or not. Even more recently, the President of Tanzania, Julius Nyerere, demonstrated the vitality of African languages by his series of literary works, including a translation of Shakespeare's *Julius Caesar*.

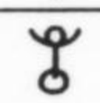
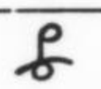
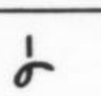
For all languages there is a problem of adaptation, but not of adaptability. Linguists know that no language lacks the ability to mould itself to a new environment. Every language has its own built-in system that meets the needs of its people. The integration of new knowledge is a matter of vocabulary; it does not affect the system, which is the structure of the language on which the vocabulary rests.

Moreover, the need for adaptation is not a problem exclusive to the languages of Africa. It is world-wide.

Japan established its economic and scientific force by assimilating modern skills and knowledge into its own language, and by introducing new techniques into its culture to which it gave Japanese words or transliterated the original foreign ones.

No language escapes this process. Why is there a "Franglais" or a "Japenglish" if not because English has

The alphabet of the King of Bamum

Words or ideas represented by original signs	Meaning	1907	1911	1916	1918	Existing phonetic value
ncha	fis'ı					ch, tch, cha
fom	king					f, fo
ngou	country					g, gou
II	adult					I, II

A remarkable example of the development of written language is that of an African ruler, King Njoya of the Bamum (Cameroons) who invented a form of picture writing at the end of the 19th century and within a few years transformed it into a syllabic, phonetic alphabet, independently and without previous knowledge of alphabetic scripts. After devising his writing system, King Njoya launched a large-scale campaign to teach the alphabet to his people. Examples above show how reforms and simplification during 11 years gave the Bamum script a more systematic form.

— *November 1950*

become the leading language of the world as a result of the contribution of American science and technology?

The best answer to the question regarding the adaptability of African languages to modern change is to remind ourselves how easily modern techniques are being assimilated into African languages. It is a truism that people do not accept all foreign words indiscriminately. Train, ship, television, mathematics, drugs—in a word all the elements of the new environment are spontaneously translated, especially by the women who often find graphic, picturesque equivalents for them.

In Wolof, for example, the word for train is *saxar*, for mathematics *wann*, for drugs *garab*, all terms drawn from the language itself. For words like television, radar or atom, commonsense operates in Africa as it has in Japan, Germany or India, and the same words are incorporated into the language with minor modifications or none at all.

Today the great problem in Africa is that of translation. School books from the primary to the university level must be translated to make them available to students. This will facilitate the broad diffusion of science and technology in Africa. It is easier, cheaper and will reach more people.

A nation's linguistic policy is not decided by the individual. The individual can make known his suggestions, his desires and his needs; but the final word rests with the State. Specialists agree that the use of the vernacular for literacy campaigns and schooling is certainly the best way to show one's regard for the culture and traditions of a people, and the most effective for making the language the vehicle of modern change; but the politician does not always see things the same way as the specialist.

However, an increasing number of countries are exhibiting a refreshing degree of understanding in this matter, and this is encouraging. In addition to those countries of Africa that have traditionally practiced bilingualism based on the use of both an African language and a European one—such as Nigeria, Ghana, the Democratic Republic of the Congo, Tanzania and Uganda—others like Niger, Guinea and Mali have shown new interest in the question.

Unesco's programme in Africa which gives priority to the question of African languages, shows that Unesco is keenly aware of this problem and its effect on the continent's educational and development policy.

Many details have as yet to be worked out in agreement with Unesco's African member countries; but the proposals elaborated at the Unesco-sponsored Congress of Bamako in 1965 for unification of certain African scripts is a step in the right direction.

— *June 1967*

Photo © Paul Almasy, Paris

With the world's oceans a convenient dumping ground for radioactive waste, scientists are on the alert for signs of contamination which could spread for millions of square miles and ultimately endanger man through the food he harvests from the sea.

THE POLLUTION OF THE OCEAN

by Nicolai Gorsky

THE amount of radioactive substances dissolved in the waters of the oceans and seas is infinitesimal and the highly diversified plant and animal life of the seas and oceans is accustomed to a very low concentration of radioactive substances. It is precisely from this quarter that a grave danger has arisen.

It is known that fishes concentrate phosphorus and zinc in their bodies, while molluscs and crustaceans concentrate calcium, strontium and a number of other elements included in radioactive fission products.

Two days after atomic bomb tests at Bikini atoll, the radioactivity of the upper layer of water increased a million times over the normal. Four months later the radioactivity of the water 1,500 miles away was three times greater than the normal. In thirteen months the contaminated water had

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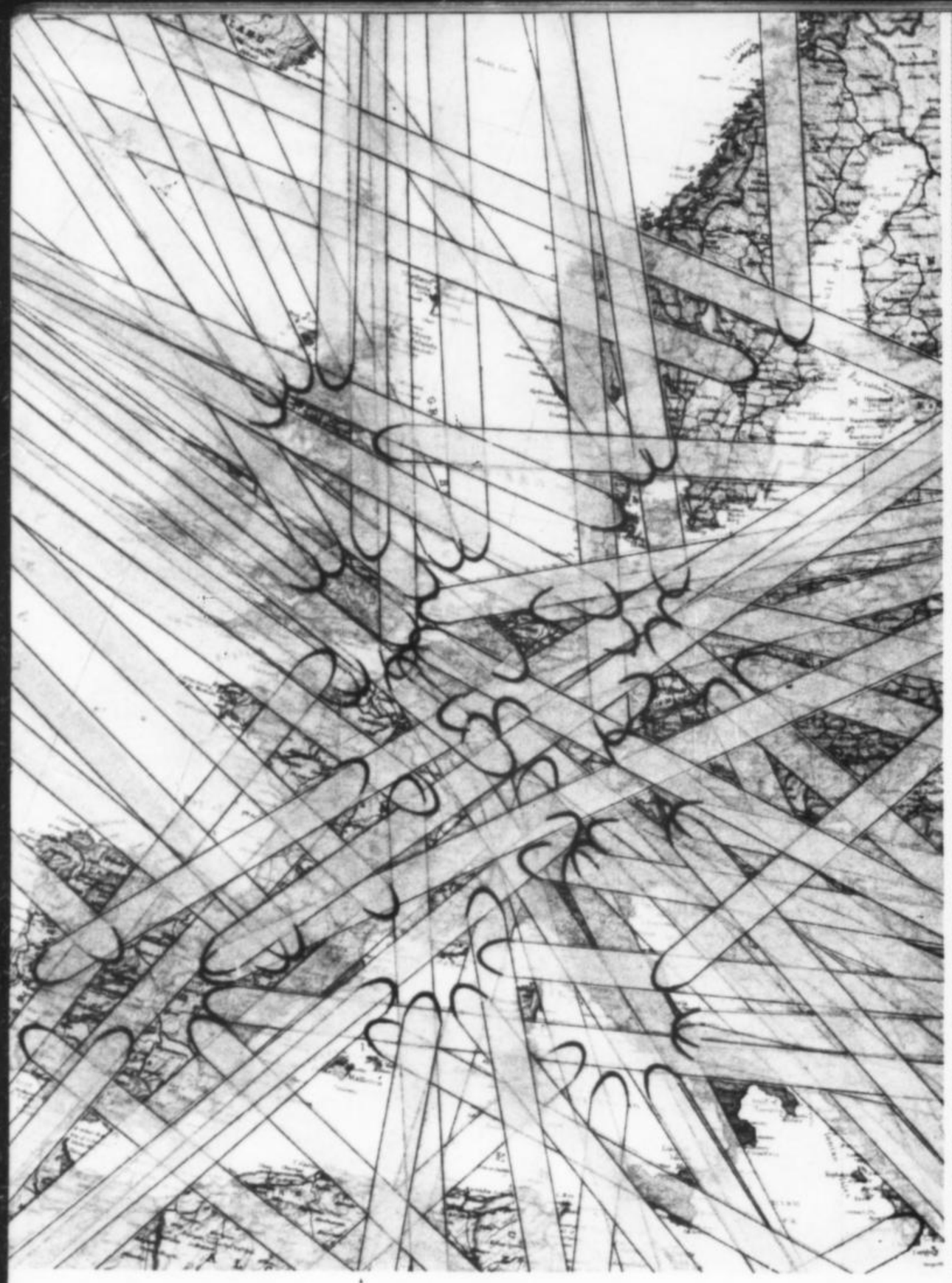

Photo to The Aeronautical Reseach Institute of Sweden

OUR POISONED PLANET

In the name of progress, Man has opened a 20th century Pandora's Box of smoke, sewage, smog, detergents and noise which together form one of the great problems of our age—the pollution of our planet. We have been dumping waste into rivers and lakes, fouling the air we breathe, damaging the soil, and assailing each other with noise, that by-product of technological civilization which increases nervous strain, deafness and other mental and physical disorders (photo below). A new noise, the boom of the supersonic jetliner, will soon be added. Map, left, shows "boom carpets" that will be "unrolled" over Western Europe unless restrictions are made or muffling measures found. — *July 1967*

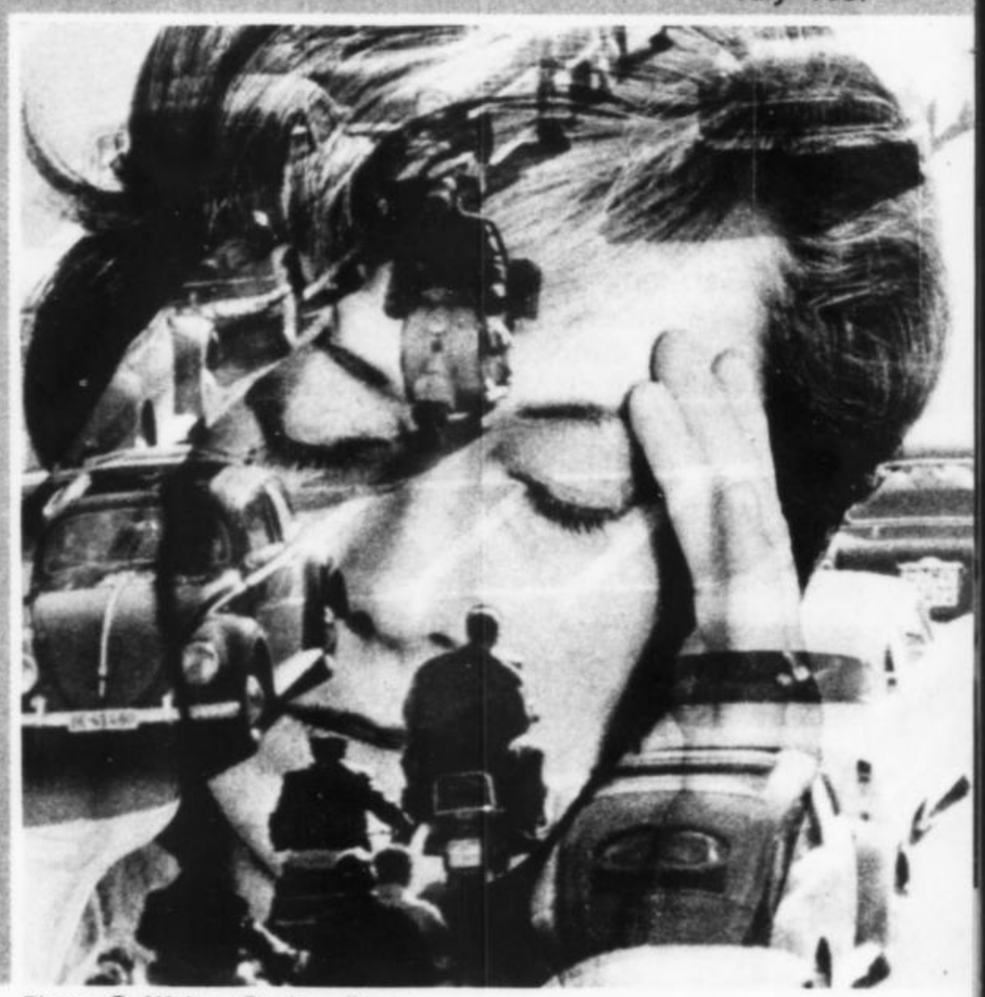

Photo © Walter Studer, Berne

POLLUTION OF THE OCEAN *(Continued)*

spread over an area of over one million square miles.

Due to the rapid development of the atomic industry the problem of safely disposing of radioactive waste-products has become urgent. In Britain, radioactive wastes are in some places drained by pipes into the Irish Sea, while at Oak Ridge in the United States they are drained into the Tennessee River system. Some wastes in the United States are buried in the ground or sunk in the deep sea in special containers.

The sea water, however, will very quickly eat through the walls of these containers and dissolve their dangerous contents. If scores, or hundreds, of containers with their sinister contents are being thrown into the sea today, the number will rise to tens or hundreds of thousands in the future.

There are deep places or trenches in the oceans, particularly the Pacific. The average depth of the ocean is about two and a half miles, but in these depressions it reaches between four and five miles and in places up to seven miles. Proposals are being made to use these depressions as dumping-grounds for radioactive wastes.

How long will it take radioactive substances dissolved by the water at the ocean bottom to rise to the surface? Will the process of radioactive decay which is always at work render them innocuous before they reach the surface, or will they still be sufficiently radioactive to poison the upper, productive layers?

SCIENTISTS hold widely differing views as to the time required for the water of the ocean bottom to be renewed. Georg Wüst (Fed. Rep. of Germany) has calculated that the cold, heavy Antarctic waters, after descending to the depths, reach the equator in five years four months, while G.E.R. Deacon (Britain) puts the figure at eighteen years. E.B. Worthington (United States) holds that the waters at the bottom of the Atlantic date back to 1810 when the climate became much colder, and have not been renewed in the century and a half that has elapsed since then.

The New Zealand oceanographers, Brodie and Burling, have put the age of the Antarctic waters north of Scott Island at a depth of 8,500 feet at 2,500 years, and of the waters near Campbell Island at a depth of 2,624 feet at 1,900 years. The New Zealanders used the Carbon 14 method to determine the age of the water, but others hold that there are a number of factors besides time affecting Carbon 14, and accordingly that these conclusions must be accepted with caution.

The Danish expedition on the *Galatea* and Soviet expeditions on the *Vityaz* found dissolved oxygen in water from the very deepest Pacific trenches. Water buried at the bottom of the ocean for hundred of years, let alone thousands, could contain no oxygen. It would be consumed in a much shorter time by various processes, both physico-chemical (the oxidation of mineral substances) and biochemical (the respiration of living organisms and the putrefaction of dead ones)—processes that are constantly at work at the bottom of the ocean and in the water above.

The Danish and Soviet expeditions discovered various forms of animal life at the bottom of the ocean trenches, which had till then been thought to be void of life. All these animals consume oxygen continually and they would long since have exhausted the

Photo © Yves Lanceau - Jacana, Paris

Photo © Gene Smith - Magnum

The primitive notion that a river is a sewer has caused many of the world's waterways to stagnate and die, killing off their once-teeming plant and fish life (above). Man's heavy hand is often most obvious in cities and industrial complexes (right) where pollution in all its forms creates a choking, poisoned environment.

supply in the water round them if there were no currents.

The water in the ocean is not homogeneous; its temperature varies both vertically and horizontally. What is more, the water in the ocean is continually in motion, neighbouring layers often moving in different directions. In this way water of different temperatures is being constantly mixed and is sinking as it becomes heavier. An equivalent volume of lighter water is displaced and rises to the surface. This eternal process extends to all the depths of the ocean, apparently penetrating to the bottom of the trenches.

We do not know as yet how long it takes surface water to descend to the ocean bottom, but evidently its movement is relatively rapid since it retains dissolved oxygen.

Among the many depressions studied by this year's Soviet expedition on the *Vityaz* was the Tonga trench, investigated six years ago by the Danish expedition on the *Galatea*. Measurements made this year gave a difference of 0.2° in the temperature of the water.

When one takes into consideration the great accuracy of the deep-water thermometers used by oceanographers, one realizes that this is a significant deviation indicating the existence of what is probably a very slow but continuous exchange of water between the bottom, intermediate, and surface layers of the ocean, even in the regions of the deepest depressions.

THE vertical circulation ventilates the deep layers of the ocean and also raises to the surface a layer rich in nutrient phosphates and nitrates, forming a basis for abundant life. But this process will bring death if pernicious radioactive solutions from the wasteproducts of the atomic industry accumulate in the ocean depths.

There is another phenomenon occuring in the oceans and seas known as upwelling. Due to winds, currents or the relief of the ocean bed, deep, cold layers of water, rich in nutrient salts, rise to the surface in some regions along the continental slope or along submerged banks. This occurs regularly along the Atlantic coast of North America, the California coast and the western coast of South America and Africa. The regions where upwelling occurs are exceptionally rich in plant and animal life, including fish. If the water rising to the surface should be contaminated with substances dissolved from radioactive wastes it will mean the end of the highly productive fisheries in these regions.

The oceans and seas are joined to form an indivisible whole—the World Ocean. No open part can be considered isolated and cannot belong to any one country. Radioactive substances introduced into the ocean at any spot will be dispersed for thousands of miles and will contaminate an area of millions of square miles.

For that reason, all questions concerning the contamination of the ocean by radioactive substances, irrespective of their origin or purpose, acquire international significance and should be solved through friendly, concerted international scientific co-operation.

The rate at which the atomic industry is developing shows that it is necessary to set about the study of this problem immediately. Uncontrolled contamination of the oceans and seas can lead to irreparable catastrophe within ten to twenty years. The Ocean, that great and inexhaustible source of food for man, is in danger.

— *July-August 1959*

700 MILLION FORGOTTEN MINDS

by René Maheu
Director-General of Unesco

AN estimated 700 million adults—or more than two-fifths of the world's total population—are illiterate. And it is in the less developed regions that most of these adult illiterates live.

As for children (5 to 15 years), 47 per cent did not attend school during 1960 in the countries of Latin America, Africa, the Middle East and Asia. If we add to this figure those children who are going to school now but who will drop out before they master reading and writing and hence will grow up illiterate, there are today 150 million future illiterates in these countries and there will be an additional 20 to 25 million illiterates added to the world's adult population in the next 6 or 7 years.

What a frightful loss of mindpower these hundreds of millions of illiterates represent. Who can say how many scientists, engineers and technicians potentially existed among all these forsaken adults as well as the children consigned from birth to the shadows of ignorance?

An illiterate person never ceases to be a human being endowed with his own natural dignity and ability. Nevertheless, illiteracy by the very fact that it makes science and technology a closed book renders active participation in modern civilization impossible.

A country with a high percentage of illiterates does not only suffer an intrinsic loss in terms of wasted man and mindpower; the progress of the educated segment of the population is equally slowed down. We can no longer afford to have, as we unfortunately do in many of the developing countries, an enormous gulf separating one group or generation from another, that is, those who have had a modern education from those who are illiterate. This disrupts the equilibrium and unity of a country and completely defeats any effort to create a nationwide positive attitude toward scientific thinking and technology without which there can be no real development.

Probably the greatest need for expansion and improvement lies in the field of technical and vocational education, particularly at the secondary school level.

Here Unesco has devoted considerable effort in recent years to helping the developing countries in two different ways: by working on international standards for technical education, and by direct aid in the field.

As for the rôle of universities in training senior scientific and technical personnel, in certain countries the problem is chiefly one of quantity. Here the key word is shortage: a shortage of universities, a shortage of instructors and professors, a shortage of equipment, mainly laboratory equipment, even a shortage at times of adequately prepared students arising from the inadequacies of secondary education.

In other countries higher education is poorly adapted to the needs of a modern economy and technology. Thus most of the university students in these countries prepare for degrees in traditional subjects; and those who do major in science and technology often do so by chance or for personal reasons that have little to do with the real top-priority problems of economic and social development in their country.

The evil of underdevelopment must be attacked at its very root by creating national structures for training qualified personnel where they do not exist and strengthening and improving them where they do.

If a country is to build a sound foundation for its technological development science must be taught in the

Photo Unesco-Unations - Basil Zarov

The thirst for learning all over the world is such that people of all ages use every opportunity to read and study. Right, an assiduous reader in India. Below opposite, youngsters spend hours studying under the street lamps in Leopoldville.

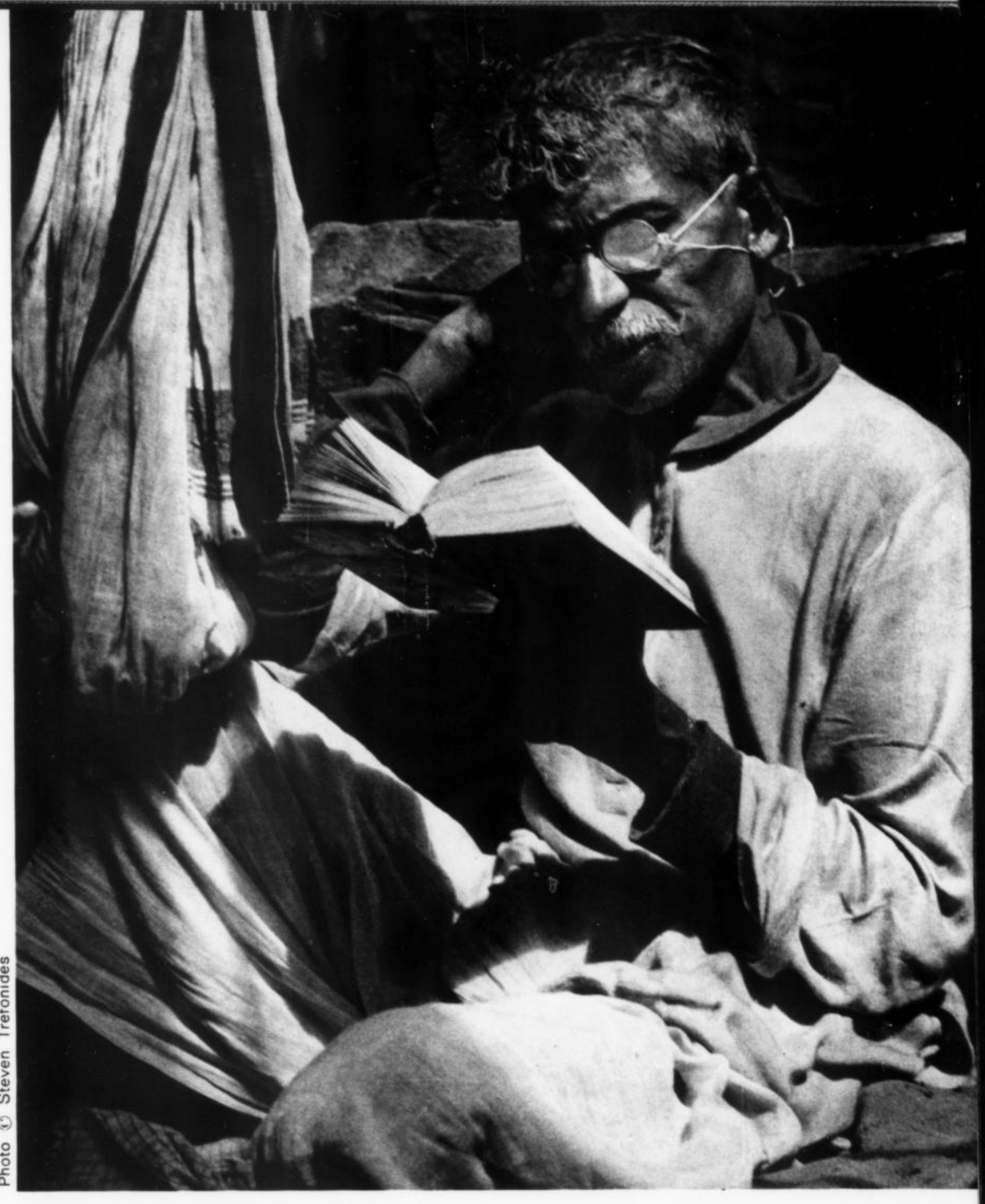

Photo © Steven Trefonides

schools at every level. The real basis for development is a scientific civilization.

Merely importing techniques will not itself equip the underdeveloped countries for the full utilization of their natural and human resources to achieve their transformation.

THERE are many things wrong with science teaching in the developing countries. There is often a terrible shortage of laboratory equipment for schools and universities.

In many cases, curricula are ill-conceived, textbooks and teachers' handbooks are not suited to local conditions, and the training of teachers leaves much to be desired.

In all these spheres, Unesco is helping to promote and support the efforts of its member states. Far greater resources must be marshalled by international aid for this vital contribution to progress.

I do not believe that the educational system, with its present organization and methods, can meet the demands of the growth of our civilization in the developed countries, let alone those in the developing areas.

Education cannot make its full and decisive contribution to the technological revolution which must take place in the less developed countries unless it itself drastically overhauls its own technology, which in many respects is out of date.

We all know what a long and costly process the training of teachers is at no matter what level. There can be no question of economizing in this vital field. But experience has shown that for certain duties, assistants with far less advanced training are quite adequate. The savings made in this way would be quite considerable.

Even the machines now being tried out for programmed instruction reduce the need for personal coaching by the teacher.

The cinema, radio and television—not to overlook filmstrips and the gramophone—have demonstrated over and over again how potent they are as means of conveying ideas, imparting knowledge, and expressing emotions and passions, too. Educators should learn what the professional entertainers and political propagandists have already found out in other fields: that these media can play an enormous rôle in advancing education in the developing countries.

It is not in schools or universities that the renewal or extension of scientific education and technical training must be effected. It must take place wherever the main part of an adult's life is spent—at work and during leisure hours.

Places of work are ideal centres for specialized scientific and technical education on a continuing basis. Industry is becoming increasingly aware of this educational responsibility which it bears. This is a task on a scale commensurate with modern society as a whole.

Major industrial and commercial concerns are bound to assume more and more the character of specialized training establishments supplementing the work of schools and universities. The university, far from ignoring or vying with them, should keep in close touch in order to stimulate and guide them, for they are its natural extension.

The considerable amount of leisure made available by industrialization is being increasingly taken over by the mass communication media. It is from these media that the vast majority of adults and even a proportion of those at school and university derive the bulk of what I would term their scientific and technical culture.

The diversity of situations which distinguish the less-developed countries from the industrialized ones calls for different approaches to the problems of development. But there are no ways and means too novel or modern for the less developed countries in applying the solutions adopted for those problems. This is why the training of scientific and technical personnel is so urgent a necessity for them. For on this personnel depends whether or not they are to play a real part on the contemporary scene.

— *July-August 1963*

AVICENNA

by Camille Aboussouan

AROUND the year 1150, at the height of the Middle Ages, the scientific and philosophical works of a great Persian thinker, named Avicenna, reached western Europe, introducing for the first time a complete, organized system of natural philosophy directly from the Orient.

This Persian scholar gave the world a vast body of works—335 in all—dealing more with science than with philosophy alone, which was to have a resounding impact on the development of knowledge in the Western World. For some 600 years, up until the 18th century, Avicenna's works on medicine remained the standard textbooks in all the universities of Europe. His studies on mathematics, physics, chemistry, astronomy and botany, his treatises on military administration and land taxation, his epistle on love, his correspondence with other scientists of his time, his philosophical, legal and linguistic essays, and even his commentaries on magic, all entitle him to be considered as one of the most remarkable figures of world civilization.

A thousand lunar years ago, in the year 370 of the Hegira (980 A.D.), Abu Ali al Husain ibn Abdallah ibn Sina, known as Avicenna, was born at Afsana, not far from Bokhara in Persia. The special care and education given him as a child permitted him to acquire an erudition rare for his time. Though Persian, he wrote many of his works in Arabic, the scientific and religious language of the Islamic world as Latin then was in the Christian West. In his native Persian he wrote several books of verse, a treatise on pulsation and a major work on the principles of science, the *Danesh-Nameh* (1).

What we know about his life has come down to us from Avicenna's own writing, supplemented by those of his disciple, Al Juzjani, and commentaries of other writers.

Like all good Muslims, Avicenna first studied the Koran; then Arabic literature, Greek philosophy, law, theology, medicine, geometry, physics and mathematics. Euclid, Ptolemy and Porphyrius were his preferred authors until he was 16 when, more learned than any of his teachers, he founded his own school and had many doctors working under him.

At the age of 18, his encyclopaedic knowledge and reputation as a doctor were so great that the ailing Emir had him summoned to his bedside. When Avicenna succeeded in curing him, the Emir rewarded him by making him a consultant on state affairs and gave him access to his rich, private library where he had plenty of free time for research and study.

When he was 21, Avicenna published his first book, *Al Majmuh*, a collection of philosophical writings. At that time he became deeply interested in politics and left Bokhara to establish himself in different courts of the Emirs of northern Persia and the Caspian shore. It was in northern Persia that he began writing the *Qanun* or "Canon of Medicine", and his first epistles.

He then left for Rai (the ruins of which can still be seen not far from Teheran) where he attended the sick prince Majd ad Dawla, and then for Hamadan where he cured the Emir and was named Vizier. There, Avicenna dealt with state affairs during the day and worked on his own studies at night.

Some of his greatest works date from this period: the *Al-Shifa* (On Healing) and especially the *Qanun fi-t-tibb*, his masterly work on medicine which was to become the "bible" of all doctors in the East and West for centuries. In this latter work Avicenna showed that the real act of seeing begins at the retina not the crystalline lens as was commonly believed, correctly defined meningitis as an inflammation of the brain membrane, recognized the various types of jaundice, postulated the theory of the transmission of certain diseases via the placenta, first proposed tracheotemy surgery, etc.

At the death of the Emir of Hamadan, his enemies imprisoned Avicenna in the fortress of Ferdajan. This enforced retirement gave him leisure to work in peace. But it did not last very long. On his return to Hamadan, where he no longer felt safe, he made plans to flee to Isfahan with the aid of his trusted companion Al Juzjani. They slipped out of town disguised as Sufis and after a 13 month journey through hostile lands reached Isfahan where they were received in honour by the Emir Alal Addin.

Avicenna completed the *Al-Shifa* in Isfahan, but this being a very lengthy work, he made a summary of it (started earlier) which is now famous as the *Al Nadjat*.

Avicenna's thinking until this time had been strongly influenced by Aristotle, and these two books are no exception. But during the later years of his life, his work and thinking were marked by a profound change.

This is clearly evident in his *Kitab al-Isarat wal-tanbihat*, or "Book of Theorems," the last of his works to come down to us complete (2). The Book of Theorems is the culmination of Avicenna's thought. In it we see the marked influence of Iranian scientific thinking, the development of his rationalist (as opposed to mystico-religious) thought.

Five hundred years before Harvey, Bacon and the Renaissance, Avicenna established a system of natural philosophy, neither Greek nor Persian, but based on scientific experiment. A universalist and rationalist, he combined in his works Greek and Oriental philosophies and Iranian science, expressed in an Arabic literary style and sense of composition rarely attained.

The great philosopher and scientist died at the age of 57 in Isfahan, the city of roses, after freeing his slaves and bequeathing all his property and belongings to the poor.

— *September 1949*

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(1) Published in French as *Le Livre de la Science*, in the Unesco Collection of Representative Works, Vol. I, Logique, Métaphysique (1955); Vol. II, Physique, Mathématiques (1958). Editions Les Belles Lettres, Paris.

(2) Published in French in The Unesco Collection of Representative Works as *Livre des Directives et Remarques*, Vrin, Paris, 1961.

COLOUR PAGES:

Opposite

At nine o'clock on the morning of September 21, 1965, this huge stone face of Rameses II (weighing 20 tons) was lifted from the façade of the Great Temple of Abu Simbel. Entirely dismantled and reassembled on a plateau high above the new water level of the Nile (raised by the construction of the Aswan High Dam), the temples of Abu Simbel were inaugurated in their new setting on September 22, 1968. Unesco launched its International Campaign to Save the Monuments of Nubia, in March, 1960.

— *July-August 1966*

Photo Unesco - Vladimir Nevadovic

Overleaf

Page 40:
"Portrait of a Girl", painted by Velazquez about 1648 (now in New York Hispanic Society collection). Velazquez, one of the great artists of all time, painted kings and jesters, princesses and humble folk, and strove to capture the everyday reality and life of the Spain of his day. Velazquez is regarded today as one of the forerunners of Impressionism.

— *December 1960*

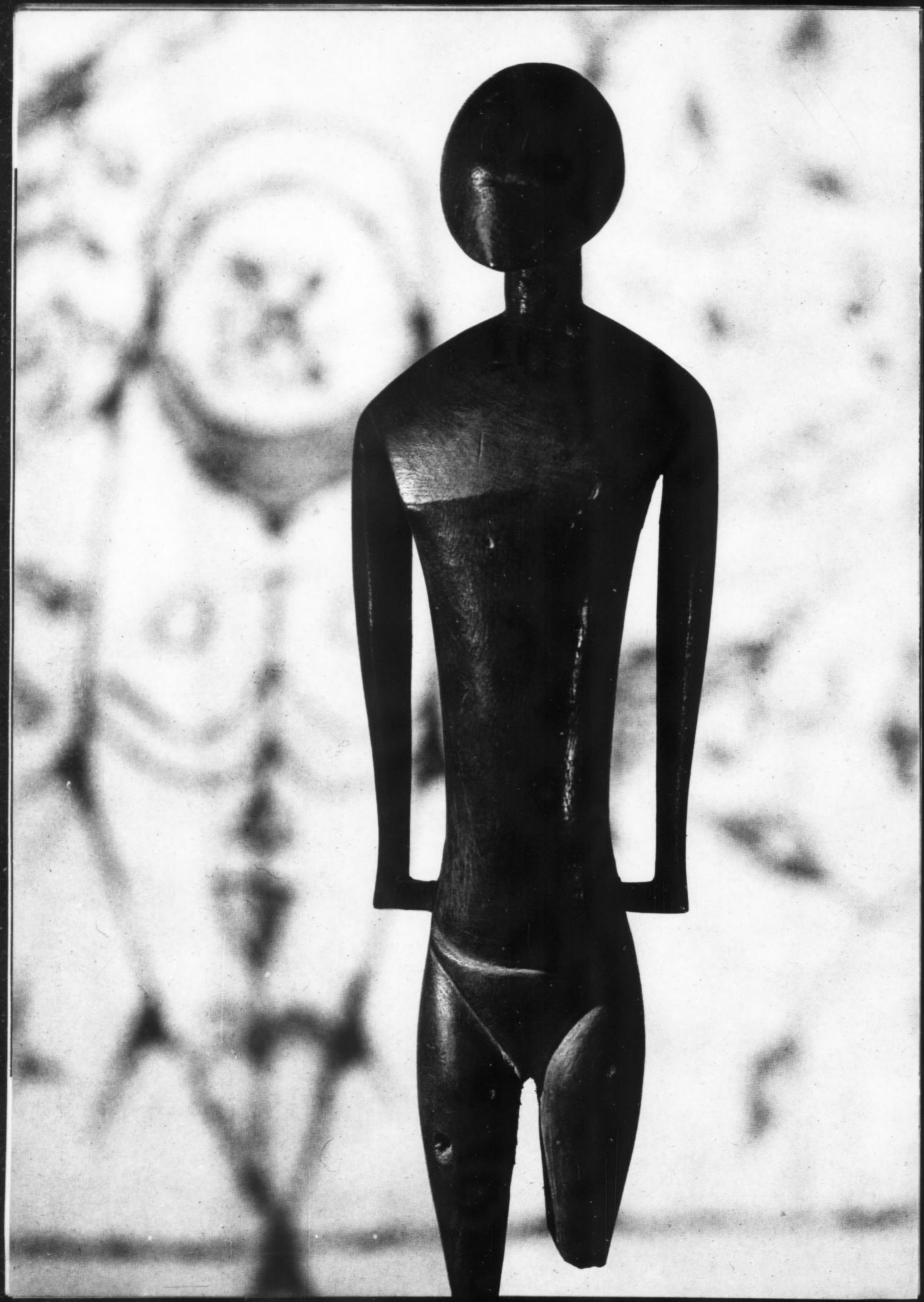
Photo © Publications Filmées d'Art et d'Histoire

Page 41:
This rare miniature, painted by the Persian artist Bihzad in 1480 depicts the garden of Prince Husayn Bayqara, an art-loving sultan. It is part of the "Muraqqa Gulshan", or Flower Garden Album, a remarkable collection of miniatures and calligraphy from different periods assembled in the 17th century and now in the Gulistan Imperial Library collection, Teheran. The work is reproduced in "Iran: Persian Miniatures—Imperial Library", one of 23 albums in the Unesco World Art Series, published between 1954 and 1964.

— *January 1957*

Photo © Unesco

CAMILLE ABOUSSOUAN, *of the Lebanon, has written extensively on cultures of the Middle East. He is now secretary of the Lebanese National Commission for Unesco.*



NUCLEAR WEAPONS AND WORLD SANITY

by Linus Pauling
Nobel Peace Prize 1962
Nobel Prize for Chemistry 1954

DURING the Second World War there were some great bombing raids on German cities. In one such raid, on one night, one thousand aeroplanes each carrying four tremendous one-ton blockbusters destroyed much of the city of Hamburg and killed an estimated 75,000 people. If there were to be such a raid on, say, Paris today and another such 1,000 plane raid tomorrow, and then another the next day and so on day after day for fourteen years, the explosives delivered would have the power of one 20-megaton bomb.

Now, one 20-megaton bomb test in the atmosphere or at the surface of the earth liberates radioactive materials into the atmosphere which will, according to the best estimates that we can make, cause gross damage or death to 550,000 unborn children. This is the probable sacrifice of the testing of a single H-bomb by any one nation. Everyone must understand this.

If the human race survives and world population continues at a reasonable level, then I have calculated that the bomb tests carried out thus far, and amounting to 600 megatons, will in the course of time affect sixteen million children so severely that they will suffer gross physical or mental defects or embryonic, neonatal, or childhood deaths.

We know that large amounts of high energy radiation produce cancer. If we accept the principle that high energy radiation even in small amounts is also cancerogenic—as I believe it is—then it is possible to calculate the sacrifice of human beings now living to the bomb tests.

The estimated figure is that two million human beings now living will die five, ten fifteen or twenty years earlier than otherwise because of cancer or other diseases produced by the high energy radiation liberated in the bomb tests carried out so far. This is about one person in fifteen hundred in the world, and it gives us some idea of the nature of atomic weapons in so far as the tests go.

Of course there would be a tremendously greater amount of contamination with radioactive materials all over the earth if there were to be a nuclear war. In addition to the destructive and lethal effects of blast, fire, and immediate high energy radiation, there would be the effects of local fall-out.

Survivors within hundreds of miles of where the bombs exploded would generally be exposed to about half of the lethal dose that causes acute radiation sickness and death within a few days, and the survivors would have their portion of the pool of human germplasm seriously affected. Their lives would be shortened considerably —on the average by some ten or fifteen years by exposure to this high energy radiation.

The standard nuclear bomb today is the 20-megaton bomb. (One megaton equals a million tons.) The Soviet Union has detonated a 60-megaton bomb, which was apparently only the

CONTINUED ON NEXT PAGE

Of what was once a man there is left only a shadow on the wall. For a single instant, on August 6, 1945 at Hiroshima, the man's body absorbed the radiation and heat from the atomic blast and traced the outline on the building behind. The man vanished. The ladder remained.

Photo © Asahi

Opposite : **This wooden statue (35 cm.; 14 in.), carved by an unknown artist of the Caroline Islands in the south-west Pacific, is remarkable for the simplicity of its form and features. The way the artist has reduced the human face to a mere outline recalls the more sophisticated treatment of modern day western sculpture.**

— December 1965

Photo © Musée de l'Homme, Paris

first two stages of a 100-megaton bomb. A 100-megaton bomb involves only about three and a half tons of explosive material and probably can be carried in a single large rocket from one continent to another. But 100-megaton bombs don't make very much sense because a 20-megaton bomb can destroy any city on earth.

A 20-megaton bomb exploded over any city on earth would destroy it completely and kill most of the people in it. It would produce a crater of twenty kilometres in diameter; it would set off fires 50 to 100 kilometres away, producing a tremendous fire storm and would damage people by the immediate high energy radiation and by the radioactive fallout. Even people 300 kilometres away would be killed.

My estimate is that the stockpiles of the world comprise about 16,000 of these 20-megaton bombs or the equivalent of them. Now, there aren't 16,000 large cities in the world and one might well ask why this irrationally great amount of explosive material has been produced.

I shall answer this by saying that it is because the system of science education has been faulty in the past so that the people who were making the decisions could not have had a clear understanding of what they were doing —if indeed anyone did make the decisions, for there has been some doubt as to whether the development of these tremendously great stockpiles was the result of decision-making rather than some sort of accident and shifting of responsibility primarily in the United States and the Soviet Union and perhaps in Great Britain to some extent.

And yet in the Franck Report written by scientists working on the atomic bomb project in the U.S. in 1945, a prediction was made of the future nuclear situation in the world which has turned out to correct up to the present time.

Three hundred and twenty thousand megatons is my estimate of the size of the world's present nuclear stockpiles. If ten per cent of the stockpiles (32,000 megatons) were to be used in a nuclear war with the bombs exploded on the average within a hundred and fifty kilometres of the targets (you don't have to hit the target in order to get the result) then 60 days after the day on which the war was fought—and we assume that it would cover Europe as a whole, all the Soviet Union and the United States—of the 800 million people living in these regions, 720 million would be dead, 60 million severely injured, and there would be 20 million survivors with only minor injuries.

But these survivors would have to cope with the problems of complete destruction of all cities, metropolitan districts, and means of communication and transportation, complete disruption of society, death of all livestock, and gross radioactive contamination of all growing foods. This would be the end of this part of the world, and how great the damage would be to the rest of the world no one has been able to estimate in a reliable way.

The partial test ban treaty signed at Moscow in 1963 was a great step forward. I regret very much that this treaty was not made three years earlier, during the long period when no bomb tests were carried out by any nation except France, which only made very small bomb tests.

Of the total of 600 megatons tested,

CONTINUED ON PAGE 46

140,000 MILLION DOLLARS A YEAR. The annual world expenditure on arms was roughly $140,000 million dollars according to an estimate made in 1964. Since then the figure has considerably increased. Expenditure on arms is equivalent to about one-tenth of the world's annual output of goods and services. It represents at least two-thirds of the entire national income of all the developing countries. It is close to the value of the world's annual exports of all commodities.

— November 1964

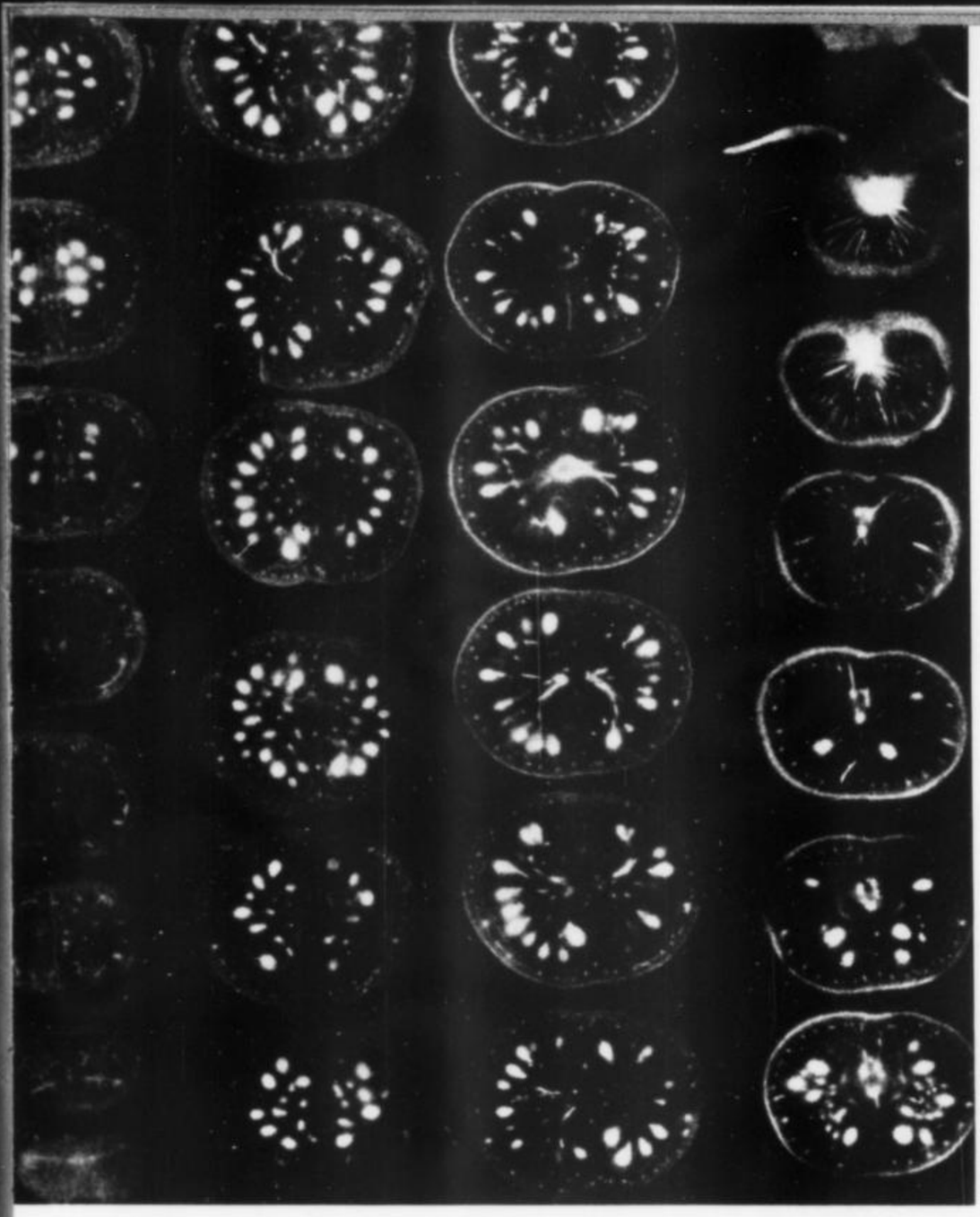


Photo USIS

Above, tomatoes "take their own photographs" after being tagged with radioactive zinc and placed on photographic plates. Radioactive substance is concentrated in the seeds. Such experiments teach scientists more about plant growth and point the way to better crops and bigger harvests.

THE PEACE-LOVING ATOM

Popular ignorance has given the atom a bad name. To the vast majority, atomic energy means horrendous explosions and the frightful weapons that could wipe out civilization. Atomic science was wholly unknown to most persons when the first atomic bomb was exploded and so it burst on mankind as an unforgettable shock.

Yet this military use of the new knowledge is only one aspect. To ignore the entire science of atomic energy, with all its possibilities for the good of mankind is like closing one's mind to all aviation because, during the war, aviation provided the merciless bomber. There is no attitude of horror today toward the aeroplane. So too there is a world of benefit in the medical, industrial and agricultural uses of the atom.

As the great explorers mapped the earth, and the astronomers chart the sky, so the atomic scientist, delving into matter and energy, has discovered an unknown world that is a revelation for philosophers and a vast resource for future generations.

— December 1953

GERALD WENDT

COST OF A NEW PROTOTYPE BOMBER WITH FULL EQUIPMENT

One year's salary for 250,000 teachers

OR

30 science faculties each with 1,000 students

OR

75 fully equipped 100-bed hospitals

OR

50,000 tractors or 15,000 harvesters

45

450 megatons or three-quarters of the total were tested in the last three years. Millions of unborn children were sacrificed because of the inability to see that the test ban solution could have been accepted three years earlier. I hope that further mistakes of this sort are not made. I am grateful for the bomb test treaty, but of course we must move forward. The test ban treaty is just the beginning.

I should like to see some action taken in the meantime that would decrease the chance of outbreak of a devastating nuclear war, perhaps through some psychological or technological accident or through some combination of circumstances such that even the wisest of national leaders could not prevent catastrophe.

In my Nobel lecture in Oslo in December 1963 [delivered on the occasion of the award to Prof. Pauling of the Nobel Prize for Peace] I proposed that the American stockpile of nuclear weapons and the Soviet stockpile of nuclear weapons should, separately, be put under joint national and international control, so that the Soviet nuclear weapons could not be used except with the permission both of the Soviet Premier and of the Secretary-General of the United Nations, and that the American nuclear weapons could not be used except by permission both of the President of the United States and of the Secretary-General of the United Nations.

I also proposed that there should be in authority in the control stations in both countries, United Nations personnel as well as Soviet personnel in the U.S.S.R. on the one hand and U.N. personnel as well as American personnel in the U.S.A. on the other. I believe that even a first step in this direction, the step of having United Nations observers in these control stations, would be of much value in increasing our security and decreasing the chance that these weapons would be used.

I look forward to the time when there is in existence in the world a satisfactory system of international law taking the place of war. In working to abolish war from the world we are working also for human freedom, for the rights of individual human beings. It is war, militarism, and extreme nationalism that are the great enemies of the individual human being in every country. I believe that as we achieve the goal of peace in the world and disarmament, we shall see great improvement in the social, political and economic systems of all nations and in the rights of individual human beings all over the world.

The idea of replacing war by world law is an old one and it has continued to be advanced up to the present time. Only now has the time come when it will be accepted.

— *November 1964*

OF ANTS AND MEN

by Sir James Gray

MAN's position in the world of Nature is brought most sharply into focus by the concept of natural evolution. Cosmic, biological and human evolution can be regarded as phases in a continuous natural process—and, from this point of view, astronomy, geology, biology, archaeology *and* history form a continuous spectrum of knowledge. To pass through many millions of years from a primaeval nebula to modern man without any sudden break in continuity of thought gives a feeling of intellectual tidiness, but quite apart from this it enables us to visualize Man against the background of his past and to regard him as Nature's supreme masterpiece. At the same time, he must not get *too* big for his biological boots or tend to exaggerate the gap between himself and the rest of the animal kingdom.

No animal can manufacture aeroplanes, or Asdic; but the prize for aeronautics must go to the shearwater which navigated the Atlantic without compass or chart, that for Asdic to the ears and vocal cords of our nearer relatives, the bats. By surrounding themselves with an electric field, some fish (e.g. *Gymnarchus)* can, in total darkness, detect foreign objects in the surrounding water with very remarkable precision.

The total weight of the mechanism involved—including the animal's brain—amounts only to a few grammes; a man-made instrument of comparable performance would involve at least a ton of highly complex electronic machinery. Again, there is no laboratory in the world which can compete with the biochemical skill of even the smallest living organism.

In fact, as delicate and precise pieces of machinery, Man's inventions so far compare very unfavourably with those which have come into existence during the natural course of biological evolution. On the other hand, we may fairly claim that we have accomplished in a few centuries things for which Nature required many millions of years.

SIR JAMES GRAY *is former president of the British Association for the Advancement of Science.*

Nevertheless, we need not be in the least ashamed of the older members of our evolutionary family; we have still a great deal to learn from them.

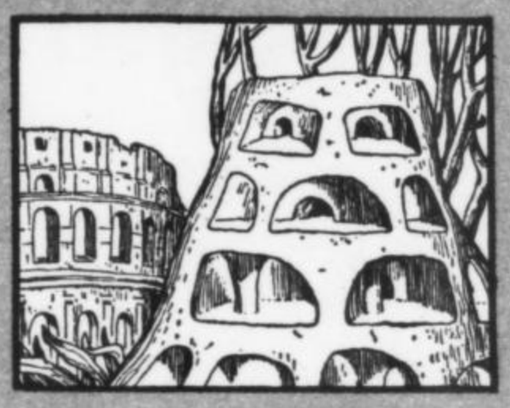
So as to visualize Man's position in the animal world, let us define his main diagnostic characters. He is a highly gregarious bipedal mammal with unspecialized limbs but a *very* large brain. He is the only animal which has developed the symbolisms of speech and writing, and he may well be the only animal capable of rational thought. He is, therefore, the only organism which can hand on patterns of acquired learning from one generation to another. To these advantages he owes his dominant position in the world today.

THEY have enabled him to exploit his environment and increase his numbers and his range of distribution far more quickly and far more extensively than any animal of comparable size. He has eliminated some of his competitors and exploited others for his own use, but the time has now come when different races of men are competing with each other within the closed arena of a limited environment, and it is not easy to see where it will end.

There is nothing equivalent to this in the inanimate world; but, when a biologist looks at the general trend of events, he is inclined to say, "Where have I seen something like this before, what is it due to, and how does it *usually* end?"

Nature has made, not one, but two *great* experiments in the design of social animals. The first was carried out in Mesozoic times when Man's mammalian ancestors were beginning to emerge from reptiles. The results of this experiment are represented today by the social insects—notably the ants.

There are a very large number of different species of ants, none of which interbreed; among them is found a range of complexity of social behaviour which is not only unique in the animal kingdom but which forms a very remarkable parallel to different races of human beings.



HIERARCHIC SOCIETY

7,000 kinds of ants are known. Mason ants build skyscraper dwellings with wonderfully domed chambers and ceilings supported on pillars.

Each ant colony is ruled by a queen. The only duty of male ants is to mate with the queen. Only queens and males have wings. All the other members of the colony—sterile female ants —are workers.

Ants practice many of the arts —and have most of the vices— of man. They are harvesters and herdsmen and raise tiny insects called aphids, which are milked like cattle for the sweet honeydew they secrete.

Each colony has a highly organized social system. Ant slaves (prisoners of war) do the most irksome jobs. Some slave-owning ants have become so lazy that when the colony moves house they have to be carried by slaves.

Each group of worker ants has its own special job. The roadbuilders are constantly at work, constructing open and covered highways.

Down these roads the colony migrates, accompanied by its cattle and slaves, to take over new territories, often waging war on other ants in the process.

Ants are clever engineers. When they reach a stream, a living bridge of ants swings across over which the whole column passes. The job each ant will do is determined from the time of its birth.

Ants are the result of Nature's first great experiment in designing social animals. Man came only 150 million years later. Has man, as a social animal, progressed much further than the ant?

— *February 1949*

Cartoon story by Frank C Betts Ltd., © by Visual Features Ltd., London

At one extreme are species forming small communities, restricted to localized or specialized environments and exhibiting relatively little subdivision of labour between individuals.

At the other extreme are large and often aggressive communities with marked differentiation of structure between different grades of individuals; populations of this type display high levels of co-operative effort involving, in some cases, the rudiments of agriculture and husbandry.

In all cases, however, ant societies are organized on a straightforward totalitarian basis, the contribution made by each individual towards the welfare of the community is determined from the time of birth; each grade of individual is structurally adapted for predetermined tasks.

How far ants can communicate with each other may be doubtful, but it is tolerably certain that members of the same community recognize each other by a characteristic smell, and as the brain of an ant is about the size of the head of a pin, it is perhaps not surprising that ants should attack or kill an individual from another colony with a smell slightly different to their own. It is much less easy to understand why a man, with a brain of an entirely different order of complexity, should, at times, react almost equally violently to skin pigments different from his own.

Ants are also the only organisms which—apart from Man—indulge in organized warfare—raiding the nests of other species and incorporating captives into their own societies. But perhaps the most striking facts relate to species which have changed their habits and distribution within recent times.

TWO instances of territorial expansion are known to have occurred in the last 150 years. Early in the nineteenth century an Eastern species *(Pheidola megacephala)*, having spread rapidly over North Africa and southern Europe, managed to reach the islands of Madeira and Bermuda; in both places it exterminated the smaller native races.

Meanwhile, a similar policy had been carried out by another species *(Iridomyrmex humilis)*, from the Argentine, which, having landed at New Orleans, very rapidly overran the southern United States; in due course, it too reached Bermuda, where it proceeded to eliminate the earlier invader.

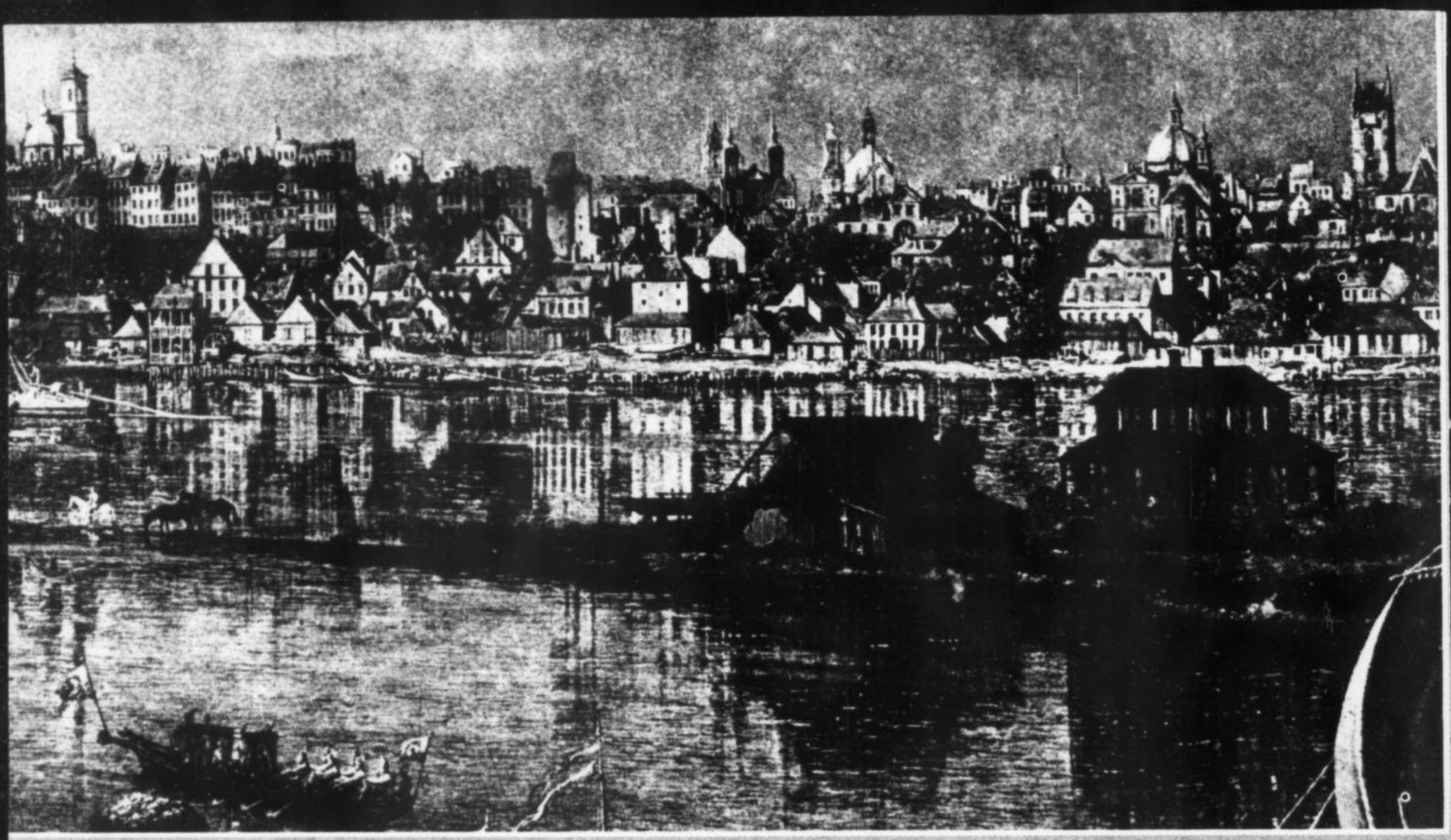
In the world of ants there is no place for small peaceful communities unless they can isolate themselves effectively from larger and more powerful neighbours, nor does there seem any lasting peace between large aggressive communities. Solomon's advice has, I suspect, been misinterpreted. It should read: "Consider the ants, and, if you use your intelligence, you will see how *not* to deal with international problems."

Having designed the ants, Nature waited for about 150 million years before embarking on her second or human experiment. She waited, in fact, until it could be carried out with a species in which an individual's contribution to society was no longer based on inherited structural characters but on the power of intercommunication with other individuals; in other words, until Man's brain had reached a level of development which enabled him to control his environment, and to deal rationally with the subdivision of labour between individuals and with the distribution of natural resources between different groups of individuals.

At the same time, she arranged that such groups should not be physiologically isolated from each other. Different races of men can interbreed, or they can, if they wish, come to mutual agreement about the distribution of world resources.

The first policy would seem to lead to a world state with uniformity of social pattern and of material interests; the second involves territorial limitations and economic agreements. Both, as we know only too well, involve great practical difficulties. All the same, men ought to be able to do something better than ants.

— *July-August 1961*



Canaletto's paintings helped rebuild shattered

by Jerzy Hryniewiecki

THE first of Warsaw's citizens who returned to the city in January 1945 found nothing but a vague trace of its former outlines visible amid the rubble—a cemetery for hundreds of thousands. A few pockmarked buildings and an area on the right bank of the Vistula alone had escaped the holocaust. Apart from its ruins, nothing remained of Warsaw... except its name.

Warsaw's reconstruction was soon being hotly debated by town planners and architects. Some had Utopian visions of a futuristic city. Many saw a unique opportunity to sweep away the past and the city's former shortcomings and to create an entirely new Warsaw. But the people of Warsaw had no time to wait. Swarming over the ruins they began to rebuild the city themselves.

In time a new city emerged that reflected the beauty of its historic past while meeting the needs of 20th century life. A dynamic school of town planning was born. Medieval squares were recreated and 17th century houses rebuilt, but behind their façades were dwellings with every modern convenience. Palaces and mansions were restored as cultural and administrative centres. The Gothic cathedral was rebuilt with its original stones. The city's new opera house was given the same classical façade as its predecessor, but behind it is a modern concert and operatic theatre ranking among the best equipped in Europe. New and broader bridges now span the Vistula on the piles of those that were destroyed.

But Warsaw's architects had recourse to a most unusual procedure in reconstituting the city's historic buildings: the celebrated paintings of Warsaw by the 18th century artist Canaletto.

To the people of Poland the name Canaletto evokes Warsaw not Venice. In 1767, Bernardo Belotto, better known as Canaletto the Younger (not to be confused with his uncle Antonio Canal—the famous Canaletto of Venice scenes) arrived in Warsaw. He fell in love with the city and remained there until his death in 1780, leaving behind him a series of paintings of Poland's capital of unrivalled fidelity: living street scenes with a wealth of detail of houses, churches, public buildings and grandiose panoramic views.

Canaletto's paintings have been called "a fascinating full-colour film of Warsaw's life in the 18th century." He always painted a building with adjoining ones, with its square or street filled with people, teams of horses and carriages, and the bustling life of the city about it.

Warsaw's architects made huge enlargements of the 25 celebrated townscapes by Canaletto in the city's national museum. They studied and recorded the details painted by Canaletto and, embodying them into the reconstructed monuments, churches and buildings, thus restored to Warsaw the true image of its ancient past.

— *March 1961*

JERZY HRYNIEWIECKI *is professor of architecture at the University of Warsaw.*

Left, panoramic view of 18th century Warsaw painted by Canaletto the Younger; below, detail of painting showing church at centre of skyline. Warsaw's architects used Canaletto's paintings as guides in reconstructing the city's ancient buildings after their destruction in World War II.

From "Canaletto", Warsaw, 1959

Warsaw

Below, Warsaw's Krakowskie Przedmiescie Street with the Holy Cross Church after post-war reconstruction. Below left, the street as Canaletto painted it 200 years ago, when it was already one of Warsaw's busy thoroughfares.

Photo © Janusz Smorgorzewski, Warsaw

PICTURES IN OUR HEADS

by Otto Klineberg

ABOUT a year ago I was in London at the invitation of British psychologists and sociologists in order to lecture on "National Stereotypes." Throughout the preceding day, during which I was undoubtedly made more sensitive by my preoccupation with this topic, I kept running into examples of such stereotyped thinking.

In my hotel, I heard someone say, "Oh, she has that Scottish stubbornness, you know". A book review in a newspaper used the phrase, "With true Gallic wit". At the theatre that evening, during the interval, I caught part of a conversation in which a pretty girl said to her escort, "I know that all Americans have a 'line'"; and in a mystery story that I read before retiring, there was a reference to "typical German thoroughness".

These are all instances of those "pictures in our heads" to which Walter Lippman gave the name of stereotypes. They are typical of the ease with which most of us generalize about national or ethnic groups, usually without even stopping to think where such "information" comes from, and whether it represents the truth, the whole truth, or anything like the truth.

There are certainly very few, if any, among us who have not succumbed to the temptation to stereotype nations. One might almost describe the tendency as inevitable, or at least very nearly so. We *know* that Englishmen are reserved, and Irishmen pugnacious; we have heard it all our lives; besides most people agree with us. But if we are asked *how* we know, we would not easily find a suitable answer.

One of the earliest careful studies of this tendency was made by Katz and Braly, in 1932, in connexion with the stereotypes held by Princeton University students. Their technique was simple.

Each student was given a list of traits, and a list of nationalities; from the first list he chose the five traits which he regarded as characteristic of each national or racial group.

We may summarize the results by indicating the three or four characteristics most commonly ascribed to each nationality. These included, for the Germans: scientifically-minded, industrious, stolid; the Italians, impulsive, artistic, passionate; Negroes, superstitious, lazy, happy-go-lucky, ignorant; the Irish, pugnacious, quick-tempered, witty; the English, sportsmanlike, intelligent, conventional; the Jews, shrewd, mercenary, industrious; the Americans, industrious, intelligent, materialistic, ambitious; the Chinese, superstitious, sly, conservative; the Japanese, intelligent, industrious, progressive; the Turks, cruel, religious, treacherous.

A study conducted in nine countries under the auspices of Unesco in 1948 and 1949, showed that such stereotyped thinking could easily be elicited almost anywhere. In each country approximately 1,000 respondents, representing a cross-section of the population, were given a list of 12 traits, and asked to choose those which they thought were most applicable to themselves, to Americans, to Russians, and in some cases, to two or three other national groups as well. They could choose as many of the traits as they wished.

The British, for example, thought of Americans as primarily progressive, conceited, generous, peace-loving, intelligent, practical. The Americans regarded the British as intelligent, hard-working, brave, peace-loving, conceited and self-controlled. The Norwegians described the Russians as hardworking, domineering, backward, brave, cruel and practical.

The "self-image" is also revealing. The British saw themselves as peace-loving, brave, hard-working, intelligent; the French saw themselves as intelligent, peace-loving, generous, and brave; the Americans saw themselves as peace-loving, generous, intelligent and progressive. All the groups agreed on one item: their own nation was the most peace-loving of all!

Few people realize how much the existence of stereotypes may colour our relations with other people, even to the extent of seeing them differently as a result.

What we see is determined in part by what we expect to see. If we believe, for example, that Italians are noisy, we will have a tendency to

CONTINUED ON NEXT PAGE

OTTO KLINEBERG *is professor emeritus of social psychology at Columbia University, New York, and director of the International Centre for Intergroup Relations, Paris.*

notice those Italians who are indeed noisy; if we are in the presence of some who do not fit the stereotype, we may not even realize that they, too, are Italian. If someone points that fact out to us and says: "Look, those people are Italians, and they are not noisy", we can always dismiss them as exceptions.

Since there is no limit to the number of cases that can be so dismissed, we may continue to cling to the pictures in our heads, in spite of all the facts to the contrary. This does not always happen. Stereotypes do sometimes change in the light of new experience. If we have had them for a long time, however, we surrender them with great reluctance.

Some years ago Allport and Postman, psychologists at Harvard University (Cambridge, U.S.A.) studied some of the phenomena associated with the spread of rumours, making use of a technique known as "serial reproduction", a very simple device which anyone can use with a group of friends.

They showed a picture to one student, and he described to a second student what he saw in the picture. The second then told a third what the first had told him ; the third told the fourth, and so on, through a series of 8 to 10 reproductions. Then a comparison was made between the final result and the original presentation.

One of the pictures showed a scene in a subway in which, in addition to a number of people seated, there were two men standing, one a white man, the other a Negro. The white man was dressed in working clothes, with an open razor stuck in his belt. It so happens that the stereotype of the Negro held by some people in the U.S.A. included the notion that Negroes carry with them an open razor, of which they make ready use in an argument.

In half of the groups who served as subjects in these experiments, before the end of the series of reproductions had been reached, the razor had "moved" from the white man to the Negro. In some instances, the Negro was even represented as brandishing the razor violently in the face of the white man.

This does not mean that half of the subjects in the experiment saw the Negro with the razor, since if only one person in the chain made this error, it would be repeated by those that followed. Interestingly enough, this did not occur when the subjects were Negroes (who rejected the stereotype), or young children (who had not yet "learned" it).

If a great many people agree that a particular trait is associated with a particular nation, does that make it true? There is a fairly widespread theory to the effect that "where there's smoke there's fire". Otherwise, the argument runs, where does the stereotype come from? How would it come into existence?

There is, however, a good deal of evidence that stereotypes may develop without any kernel of truth whatsoever. We all know how widespread is the notion that intelligent people have high foreheads, yet scientific investigation in this field has failed to reveal any such relationship.

The stereotype of the criminal as bearing in his features the mark of his criminality is widely accepted, but it is equally without foundation; the famous British criminologist, Sir Charles Goring, was able to demonstrate that a composite photograph, representing criminals in British gaols, bore no resemblance to the accepted stereotype of the criminal.

Stereotypes frequently change. In some cases it may be argued that this corresponds to a real change in the characteristics of the people; in others, however, it seems much more likely to be due to external circumstances which have little or nothing to do with the group concerned.

The Dutch sociologist, Den Hollander, has studied the historical changes in the stereotype of the Hungarians in Europe. He points out that for centuries after the migration of Hungarians to Central Europe, they had a bad reputation, and were regarded as culturally different, and therefore inferior to Europeans generally. During the 15th and 16th centuries, however, when they joined in the war against the Turks, they were pictured as a brave, devout, and chivalrous people.

By the second half of the 18th century their popularity had again declined, and they were described as savage, lazy, egotistical, unreliable, and tyrannous. This picture changed again a little later, when the Hungarians became romanticized and idealized. Den Hollander believes that the image followed the pattern of political inter-relationships; it seems unlikely that there was sufficient transformation in the character of the people to justify the change in the national image.

THE American sociologist, La Piere, studied the attitudes of residents of California towards first and second generation Armenian immigrants in Fresno County in that State. There was almost complete agreement that these Armenians had more than their share of faults, and the general attitude toward them was relatively unfriendly.

La Piere proceeded to question non-Armenians as to the reasons for their antipathies, and he was able to classify the answers into three stereotypes. In the first place, it was stated that Armenians were treacherous, lying, deceitful. In actual fact, when measured by the criterion of business integrity, the Armenian merchants turned

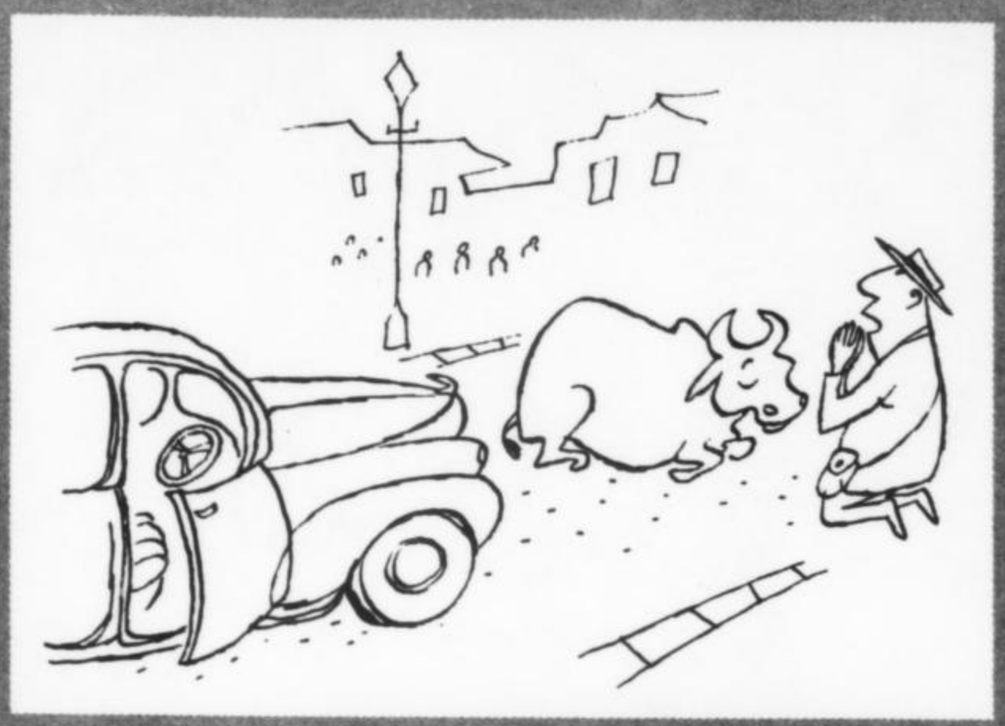
out to be equal and frequently superior to others.

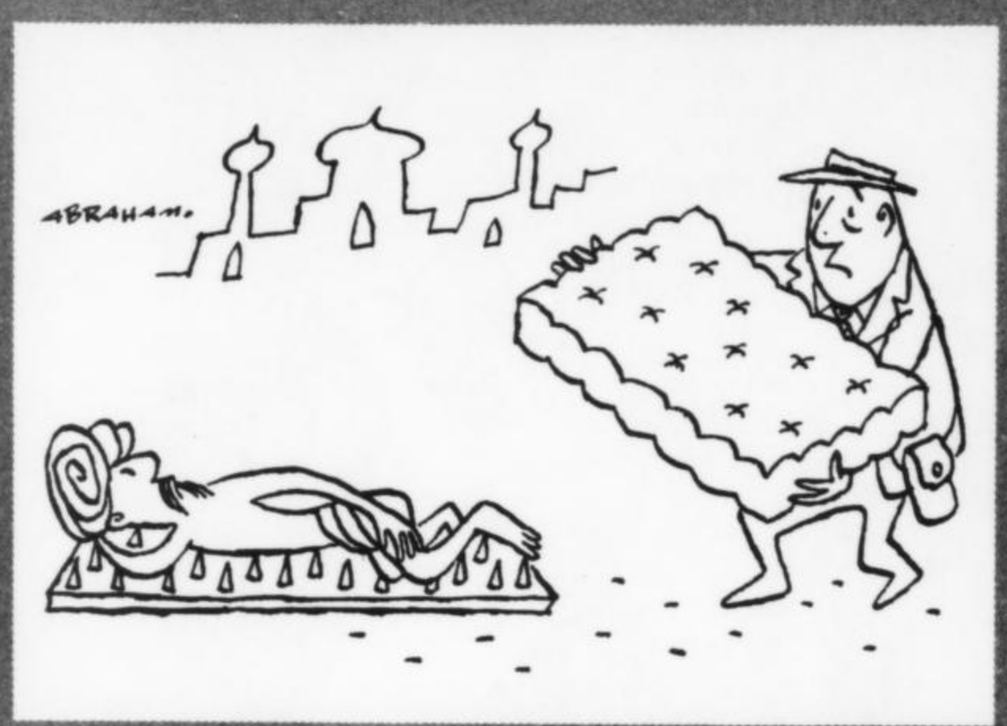
In the second place, they were alleged to be parasites, making excessive demands upon charitable organizations, free clinics, etc. Actually, such demands by them were less than half of what would be expected in terms of their proportion of the population.

Finally, it was said that they had an inferior code of morality, and they were always getting into trouble with the law. In fact, police records showed that they appeared in only 1.5 per cent of Police Court cases, although they were about 6 per cent of the population.

La Piere concludes that all of these stereotypes have one factor in common, viz. that they are definitely false. This does not mean that stereotypes *never* contain any truth. It does mean that they *can* develop without any truth whatsoever.

Stereotyped thinking may be *almost* inevitable, but there is good evidence that it can at least be reduced, if not eliminated. Eighteen years after the Katz and Braly study, another psychologist (Gilbert) applied the same technique to a new generation of Princeton students. He found that there was some persistence of stereotypes, but also a very important change which he describes as "a fading effect".





'TAKE-OFF' ON STEREOTYPES ABOUT INDIA

These drawings are take-offs by an Indian artist, A. M. Abraham, poking fun at some of the stereotypes Westerners often have of Indians and India. The cartoons were specially drawn for the 'Unesco Courier' by Mr Abraham and published in June 1955.

There is much less agreement among the students in 1950 than in 1932; any specific trait is usually checked by a much smaller proportion of students in the later study. In 1932 for example, 84 per cent of the students described the Negroes as lazy; in 1950 the percentage had dropped to 31. The description of Italians as artistic drops from 83 to 28.

In London, a Unesco study conducted by H.E.O. James and Coran Tenen, showed how specific personal experiences might affect the nature and content of stereotypes. What they did was to obtain from schoolchildren their opinions of other ethnic groups particularly of African Negroes, and then bring them into contact with two able African women teachers who spent a few weeks in the schools.

The "before and after" picture is very striking. As an example, a child before the experience stated that "I do not like black people; it's the colour; it makes me nervous; they might be savage... they are different in nature from us, more savage and cruel sometimes, so you don't trust them ever." The same child after the experience said: "Miss V. and Miss W. were nice people... there does not seem any difference between them and us except the colour. I think that Negroes are like that—just like us, except for the colour. I like them. They are nice people."

The authors give many examples of similar changes that occurred. Stereotypes cannot always be modified so strikingly nor so fast, but the fact that they can be changed at all as a result of experience is itself encouraging.

Sometimes just growing older helps. In a study sponsored by Unesco, Piaget and Weil report the results of a series of interviews with Swiss children of different ages. One interview with a little girl aged eight years ran as follows:

"Have you heard of foreigners?—Yes, there are Germans and French. Are there any differences between these foreigners?—Yes, the Germans are bad, they are always making war. The French are poor and everything is dirty there. Then I have heard of Russians, but they are not at all nice.—Do you have any personal knowledge of the French, Germans or Russians, or have you read something about them?—No.—Then how do you know?—Everyone says so."

On the other hand, a boy aged thirteen years, after having mentioned a large number of foreign countries of which he had heard, was asked. "Are there any differences between all those countries?", and his answer was, in part, *"you find all types of people everywhere."* We are not all as "mature" as this 13 year-old boy, but perhaps we can move in that direction. Or is it possible that the Swiss are...? Oh no! No stereotypes!

The understanding of national characteristics represents an important task for all of us. The difficulties in the way are great: nations are made up of many different kinds of individuals, and generalizations are dangerous if they do not give adequate consideration to the range of individual variations.

An important first step will be taken if we treat "the pictures in our heads" with a strong dose of scepticism, and if we keep our minds closed to stereotypes and open only to facts. No one is denying the existence of national characteristics.

A knowledge of them can aid our understanding of people, as well as our enjoyment of the varieties of behaviour and personality that are found in different parts of the world. We need to make sure, however, that the "pictures in our heads" correspond as closely as possible to reality.

— *June 1955*

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THE ART OF DECORATING OURSELVES

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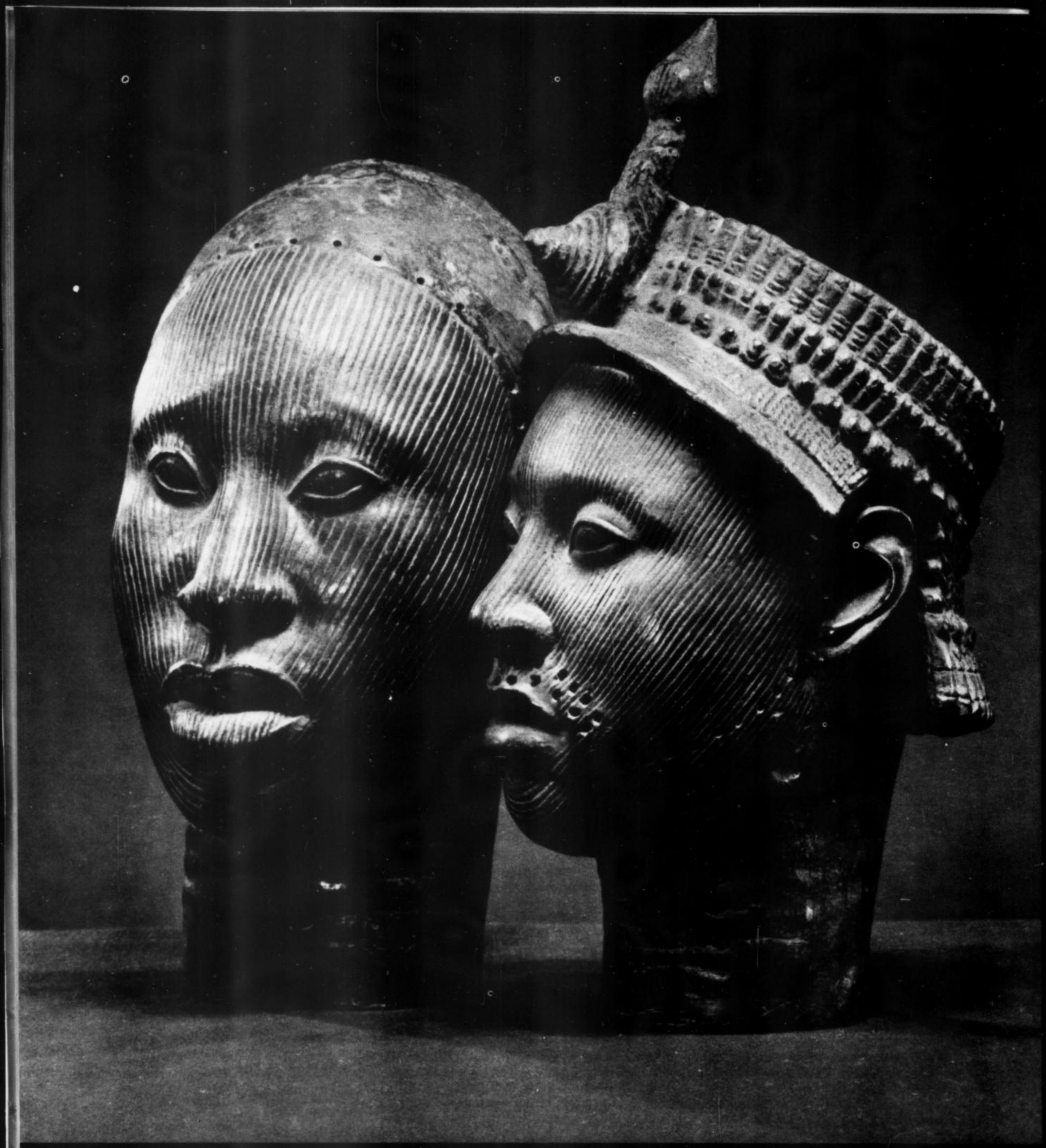


Photos © American Museum of Natural History, New York

Few forms of behaviour are more common or more widely accepted than the urge to improve on nature by adorning the body, particularly... from the neck up. Not only do we adorn ourselves because our cultural conventions require it, but we do so in strictly regulated ways. And fashion is a capricious tyrant. What is most desirable and sought after today may be completely "démodé" tomorrow. Thus bodily decoration takes an infinite variety of forms. — 1. Rattan hat worn by Ilokano mountain people of Northern Luzon (Philippines). — 2. Hopi Indian (Arizona, U.S.A.) head-dress worn by unmarried girls. — 3. Fur and silk hat from Mongolia. — 4. Iroquois (New York State) man wearing dyed deer hair roached head-dress, face paint, silver crescent-shaped earrings and bear-claw necklace. — 5. Hat adorned with feathers worn by Azande from the Congo. — 6. New Guinea man with "upsweep" hair-do, drawn through a basket funnel. — 7. Bronze casts of Ife heads (Nigeria) showing entirely different types of head-dress.

— *July 1958*

IN THE CENTRE OF THE MAP

by Marshall G. S. Hodgson

IN the sixteenth century the Italian missionary, Matteo Ricci, took with him to China a European map of the world showing the new discoveries in America. The Chinese were glad to learn about America, but one point in the map offended them. Since it split the earth's surface down the Pacific, China appeared off at the right-hand edge; whereas the Chinese thought of themselves as literally the "Middle Kingdom", which should be in the centre of the map. Ricci pacified them by drawing another map, splitting the Atlantic instead, so that China appeared more central; and maps are still commonly drawn that way in that part of the world.

Europeans have clung to the first type of map, showing Europe in the upper centre; while the commonest maps in North America show the U.S.A. in that post of honour, even at the cost of splitting a continent in two. The temptation not only to put one's own land in the centre of the map, but one's own people in the centre of history, seems universal.

The most famous case of this is indeed that of the "Middle Kingdom". Many Chinese used to suppose that the Temple of Heaven at the Emperor's capital, Peking, marked the exact centre of the earth's surface.

Chinese scholars even in the Middle Ages were aware that China could not be said to be mathematically central; they knew the general lay of Europe and Africa and the Indian Ocean, and a writer could remark that the "centre" of the earth was along the equator. Nevertheless, even for sober historians the pivotal fact of human history was the condition of the great Chinese empire, in which was concentrated all the splendour of polished civilization.

For the medieval Hindu the world was a place for the purification of souls. Kings and their empires came and went, the gods themselves arose and perished—time was infinite, space immense, with unlimited opportunity for every soul to reap in birth after rebirth what it had sown.

As a given cosmic cycle wore on, disorder increased and justice faded. Our own age (the Hindus explained) was in the latter part of such a cycle; only in the central parts of the earthy regions—in India, that is—was society still well ordered: there Brahmins still offered sacrifices and the other castes ruled or served according to their status.

In the benighted lands to the east and west—so tainted already with decline that pious Brahmins dared not set foot there—souls were doomed to be born as barbarous Mlecchas; there they lived unhallowed lives till they earned the right to be born in India.

As our degenerate age drew on, even in India itself the social order was upset, rulers rose from the basest castes, and finally even Mlecchas entered as conquerors—Muslims from the west, and even remote Europeans.

Through all this outward humiliation, however, the Hindu could know that there in the central lands where the sacred Ganges flowed he could still live the way of truth and holiness—inaccessible to lesser breeds of men—and aspire to the highest degrees of rebirth.

To the medieval Muslim, Mohammed's birthplace, Mecca, was the centre of the earth's surface; here was the very throne of God, where heaven and earth were nearest.

To be sure, scholars knew that the earth was a sphere, and God equally present everywhere in the hearts of the believers. But their more sober picture of the world was equally effective in supporting the eminence of Islam. They thought of the inhabited quarter of the globe as a land mass lying between the equator and the North Pole, and between the oceans to the west and to the east—roughly Eurasia and northern Africa.

THIS was divided into seven "climes" from south to north, and from extreme heat to cold. Muslims writing in the latitude of Syria or Iran explained that in the hot south men grew lazy and so remained backward in civilization; and likewise in the far north where it was too cold—in northern Europe, for instance—men's skins were pallid and their minds sluggish.

Hence it was that only in the central, moderate climes, like the Mediterranean lands or Iran, were minds most active and civilization most advanced; from there the blessings of Islam were gradually being brought even to the remotest areas, among the Negroes in the hot south and the white men in the cold north.

The West-Europeans of the same age had many of the same ideas of history and geography as the Muslims, getting them from the same Greek and Hebrew sources; but their interpretation was very different. For them history was the story of God's progressive dispensations of law or of grace to his favoured people. Out of the descendants of Adam, God had first chosen the Hebrews, but with the coming of Christ it was a "new Israel", the Christians, that received His favours.

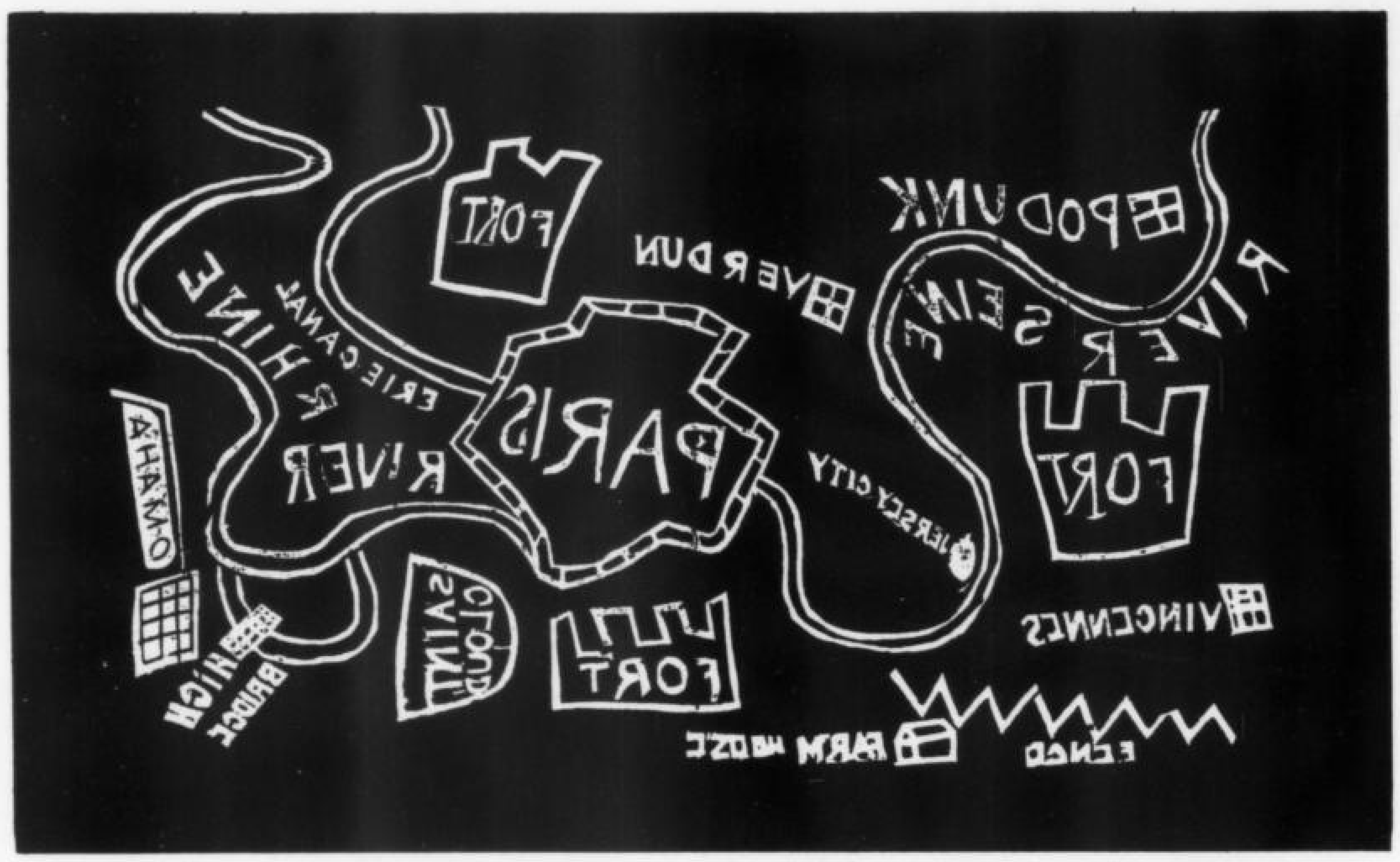
Even among the Christians God had made a further selection—casting aside those of the Levant and Greece as heretics or schismatics, in favour of the West-Europeans under the Pope at Rome. The favoured peoples of each age lived under a succession of great monarchies: in earlier times Chaldean, Persian, and Greek, which all conquered the Hebrews; but last and greatest, under which Christ Himself was born, the empire of Rome in the west, which should endure till Judgment Day.

WEST-EUROPEANS allowed that the centre of the world's surface was Jerusalem (by exaggerating the length of the Mediterranean, their maps could show Spain and China as equally distant from it); but they assured themselves that, just as at the beginning of history Paradise was in the east where the sun rises, so in these latter days the centre of God's vicarship on earth was in the west, where the sun sets; henceforth Rome was the centre of all authority, spiritual and temporal.

With the discovery that Earth is a tiny planet in an immensity of space, that mankind has been upon it hundreds of thousands of years and is still a newcomer, we have had to rethink our situation. The great ideals of faith and of culture have to be seen in spiritual terms rather than as reflected in the map of the universe.

The West-Europeans were the first to be really faced with the new discoveries and have consequently led the way toward creating a new picture of the world. But they have not yet escaped the temptation to make geography and history centre upon themselves.

One need only examine the table of contents of any proper Western "world history". Civilization began in Mesopotamia and Egypt (with perhaps some local variants in India and China); but (it would seem) soon history was almost a monopoly of the Greeks; and though other peoples might still be curious, in their quaint ways, hereafter it was really Europe that



We reproduce here a burlesque map of the fortifications of Paris drawn by Mark Twain and published in the "New York Herald" of Sunday, October 2, 1870. At this time the siege of Paris during the Franco-Prussian war had just begun and newspapers the world over were filled with maps of Paris as is journalistic practice. Below we publish the text written by Mark Twain for his map.

— August 1957

MARK TWAIN'S MAP OF PARIS

TO THE READER

The above map explains itself.

The idea of this map in not original with me, but is borrowed from the "Tribune" and the other great metropolitain journals.

I claim no other merit for this production (if I may so call it) than that it is accurate. The main blemish of the city paper maps, of which it is an imitation, is that in them more attention seems paid to artistic picturesqueness than geographical reliability.

Inasmuch as this is the first time I ever tried to draft and engrave a map, or attempt anything in the line of art at all, the commendations the work has received and the admiration it has excited among the people have been very grateful to my feelings. And it is touching to reflect that by far the most enthusiastic of these praises have come from people who know nothing at all about art.

By an unimportant oversight I have engraved the map so that it reads wrong-end first except to left-handed people. I forgot that in order to make it right in print it should be drawn and engraved upside down. However, let the student who desires to contemplate the map stand on his head or hold it before her looking-glass. That will bring it right.

The reader will comprehend at a glance that that piece of river with the "High Bridge" over it got left out to one side by reason of a slip of the graving-tool which rendered it necessary to change the entire course of the River Rhine or else spoil the map. After having spent two days in digging and gouging at the map, I would have changed the course of the Atlantic Ocean before I would have lost so much work.

MARK TWAIN

OFFICIAL COMMENDATIONS

It is the only map of the kind I ever saw. (U.S. Grant)

It places the situation in an entirely new light. (Bismarck)

I cannot look upon it without shedding tears. (Brigham Young)

My wife was for years afflicted with freckles, and though everything was done for her relief that could be done, all was in vain. But, sir, since her first glance at your map, they have entirely left her. She has nothing but convulsions now. (J. Smith)

If I had had this map I could have got out of Metz without any trouble. (Bazaine)

It is very nice, large print. (Napoleon)

I have seen a great many maps in my time, but none that this one reminds me of. (Trochu)

It is but fair to say that in some respects it is a truly remarkable map. (W.T. Sherman)

I said to my son, Frederic William, "If you could only make a map like that, I would be perfectly willing to see you die—even anxious." (William III)

counted—and after the rise of Rome only Western Europe; here was the home of truth and liberty.

If during long centuries it was hard to find either truth or liberty in Western Europe, this period was regretfully labelled the Dark Ages of mankind; but in modern times the West-Europeans have duly gone forth to enlighten (and subdue) the world—so that the history of a henceforth "Westernized" world may be safely reduced almost to that of the West itself.

In European "world atlases" each European country has its own map, with the rest of the world in a few pages at the end. The map ordinarily selected to show the world as a whole is ideally suited to reinforce this way of seeing mankind.

On the Mercator world map not only is Europe in the upper centre: it is represented as a good deal larger than the other great culture areas. Most of these lie south of the fortieth parallel, while Europe is almost wholly north of it, where Mercator's projection begins to exaggerate the size of things enormously.

Accordingly even on the world map, which ought to provide a sense of proportion, there is space to name a great many places in Europe, while in other populous centres like India or China, shown on a much smaller scale, only a few chief places need to be indicated.

Although equal-area projections of the world have long been available, in which shapes as well as sizes are much less distorted, Westerners understandably cling to a projection which so markedly flatters them. They explain (as if they were engaged in nothing but sailing) that the true angles given on the Mercator map are of convenience to navigators; and in atlases and wall-maps, in books of reference and in newspapers, when Westerners turn to see what the world looks like as a whole, their preconceptions are authoritatively gratified.

The story is often told of a small tribe whose word for "mankind" was the name for the tribe itself. Other tribes were merely incidental in their picture of the world—perhaps not even fully human. Chinese, Hindus, Muslims, and Westerners alike have smiled perhaps too quickly at the rather perilous naïveté of that small tribe.

— March 1956

THE NEW SCIENCE OF ART CONSERVATION

by Harold J. Plenderleith

THE temple, the statue and the totem pole have to withstand the action of wind and rain, heat and cold. Old ships such as the Vasa (raised from the sea bed in Stockholm harbour); or the Victory (preserved at Portsmouth, England), provide special problems concerned with the control of humidity, prevention from shrinkage and protection from insect attack. Mural paintings are normally sheltered from extremes of temperature but may be invaded by capillary moisture and attacked by mould.

Science in our generation is at last working in the service of monuments and of museums in co-operation with the art critic and the archaeologist.

Synthetic materials have been developed that can be used as an impregnating medium on tempera painting without imparting any residual shine. It can also be used to consolidate pottery from salty deserts whilst the salts are being washed from it and is readily removed afterwards if desired.

It is now possible by soft X-rays to record through a painting the original crayon sketch made by the artist on his canvas. Only a few years ago this would have been regarded as miraculous. It is also possible to remove a fresco from the wall and leave behind the mural painter's original drawing, thus exposing for the art critic a stimulating new world of interest.

In Moscow, certain painted icons have been found to be built up in a series of strata on one and the same wooden panel, and a special technique has been evolved whereby it is possible to recover the lower and older ones without losing those above. Pictures can be transferred from worm-eaten panels and mounted on sound ones, and in other cases rotting canvases are replaced by new ones. In fact, the most delicate material and most complex structures can be saved by the skill of the modern restorer.

In the field of archaeology, the mechanism of metallic corrosion, a universal cause of deterioration, is now well understood and means have been devised to remove it or, at option, to arrest its advance without necessarily destroying the aesthetic character of the piece.

There is hope that many of the world's monumental treasures that are threatened by exposure to atmospheres polluted by industrial fumes may be saved—objects universally acclaimed such as the splendid gilt bronze horses of St Marks, Venice, or the lion and griffon of Perugia—whereas, in the absence of these recent advances in the service of conservation, their years were numbered. The threat will remain, however, as long as we are content to breathe air that is polluted with sulphur compounds. The cumulation action on metals is as devastating as it is on the human subject!

An altogether new field has been opened up by the physicist in the application of his methods, of non-destructive testing, and these have already made notable contributions to the conservation of monuments. An example that immediately comes to mind of modern science in action is the discovery and excavation of an Etruscan tomb.

First the scientist applies his stethoscope to mother earth. The detection equipment of the Lerici Foundation in Italy, famous for its discoveries of Etruscan tombs, can be compared with a stethoscope in sensitivity. When the scientist detects a discontinuity beneath the surface he can pinpoint the centre of a subterranean chamber and fix his instruments with such care that on drilling vertically and inserting a special tubular periscope with appropriate lighting, he has a

Photo © Epoca - Giorgio Lotti, Milan

Hundreds of thousands of rare books and manuscripts were damaged by the floods that overwhelmed Florence, Italy, in November 1966. Here, a roomful of volumes that were taken apart, washed page by page and injected or fumigated to combat mould, their worst enemy. Inestimable damage was also caused to countless art treasures in Florence during the flood, which led Unesco to launch an international rescue operation.

HAROLD J. PLENDERLEITH *is director of the International Centre for the Study of the Preservation and Restoration of Cultural Property, in Rome.*

Photo © Solvay, Paris

complete view of the interior. All that has been done to make this possible is to drill a little hole in the ground 10 cm. in diameter.

That, however, is no more than the beginning. He has located the tomb. He now proceeds to insert a small camera into the tube and he takes a series of colour photographs, rotating the camera through 60° between each. When these photographs are laid out in orderly succession, there is a complete record of the paintings that commonly adorn the walls, of any bas-reliefs and of grave goods, etc.

Here is the monument disclosed for study yet without a sod being turned. A decision has now to be taken and an important deduction made. Is the tomb worthy of the time, care and cost, necessary for its scientific excavation? If not, it can be sealed and concealed and we are the richer for the documentation that has already been obtained.

If, however, it is decided to excavate, the photographs will show how to go about it for they will disclose the position of the entrance door: the location of the entrance passage can be deduced, and instead of breaking in through walls or ceiling, as happened in previous generations, the excavation can be so conducted as to avoid all damage by entering the tomb from the side by its own passage and

CONTINUED ON PAGE 78

This wooden statue is being injected against a scourge that could reduce it to powder. About 80 per cent of works of art in wood are invaded by insects which thrive on a diet of dry old wood, in which they live and proliferate, boring out innumerable tunnels in the process. Today, special chemicals are injected to kill the insects and prevent reinfestation. Objects seriously weakened by wood-boring insects can be consolidated by deep injections of plastic solutions or emulsion.

Photo © Emil Brunner Braunwald, Switzerland

THE WORLD'S GROWING WATER SHORTAGE

OUR need for water is constantly increasing. Though it is difficult to calculate the exact amount, it is safe to say that in 20 years' time the demand for water will be roughly double.

Faced with such a situation it is obvious that we should search as widely as possible and with every available means for sources of fresh water that seem to be the least costly. But where do these sources exist? Only a sustained and co-ordinated programme of scientific observation and research in hydrology will tell us the answer. This is the purpose of the International Hydrological Decade, 1965-1975.

Underground water reserves are much larger those on the surface, but as they are unseen we tend to underestimate them. It is vitally important that we make use of these underground reserves, but never haphazardly. For example, where does the water come from which we find in one or another of the underground water-bearing layers ('aquifers')? How does it move? How is it renewed? And if this water is used, what effect will it have on the discharge and future level of the water table? What are the laws of hydrogeology? Despite the immense progress of recent years, all these questions have still not been fully answered.

A similar need for scientific research exists in the branch of hydrology that deals with the quality of water. In nature, there is no water like the pure water defined by chemists, made up of only hydrogen and oxygen. River water, ground-water, and even rainwater always contain other dissolved or suspended elements, and these, even when present in small quantities, play an important rôle.

In the case of irrigation farming, for instance, every drop of water brings with it a little salt: the water evaporates, but the salt remains and gradually poisons the soil and plants. In general, we now know how to remedy this problem of salinity with the help of leaching and drainage.

But many questions remain unanswered regarding the effect of irrigation and drainage on the quality of ground-water, and the possibility of maintaining the ground-water level below the zone of the plant roots while bringing to the surface the water necessary for irrigation.

What happens exactly in this thin layer of soil which preserves the moisture necessary to plant life? What form—liquid or vapour—does the water take in this zone? What forces act on the water, depending on the kind of soil present? How long will this life-giving moisture last?

Evaporation from the soil and transpiration from vegetation are responsible for the direct return to the atmosphere of more than half the water which falls on the land. How exactly do these phenomena, which represent an enormous loss of resources, occur? What part does a forest play in the water balance-sheet of a given area? Does it act merely as a water-consuming mechanism operating through the absorption and transpiration of the trees—thereby reducing the quantity of runoff which reaches the rivers—or, on the contrary, does it result in a slow seepage into the earth which can later be recovered in the form of ground-water, while at the same time preventing erosion?

These are the kinds of problems which still have to be resolved: the answers will only be found through a vast programme of scientific research.

The International Hydrological Decade is such a programme. It is making possible the global observation of hydrological events—the quantities of rain and snow that fall, the discharge of rivers and underground reserves—and a world-wide stocktaking of our water resources. It is promoting scientific research in every branch of hydrology: water run-off, soil moisture, evaporation, movement of ground-water, the dynamics of lakes, estuaries and deltas, the evolution of glaciers and the geochemistry of water. It is a unique co-operative enterprise to provide the scientific foundations for decisions that governments must take to meet the world's growing need for water.

— *July-August 1964*

MICHEL BATISSE
Head of the Division of Natural Resources
of Unesco's Dept. of the Advancement of Science

Palm trees seen in this striking air view of the Sahara have survived by drawing nourishment from underground water, one of man's almost untapped resources. First half mile of the earth's crust is thought to contain about one million cubic miles of water.

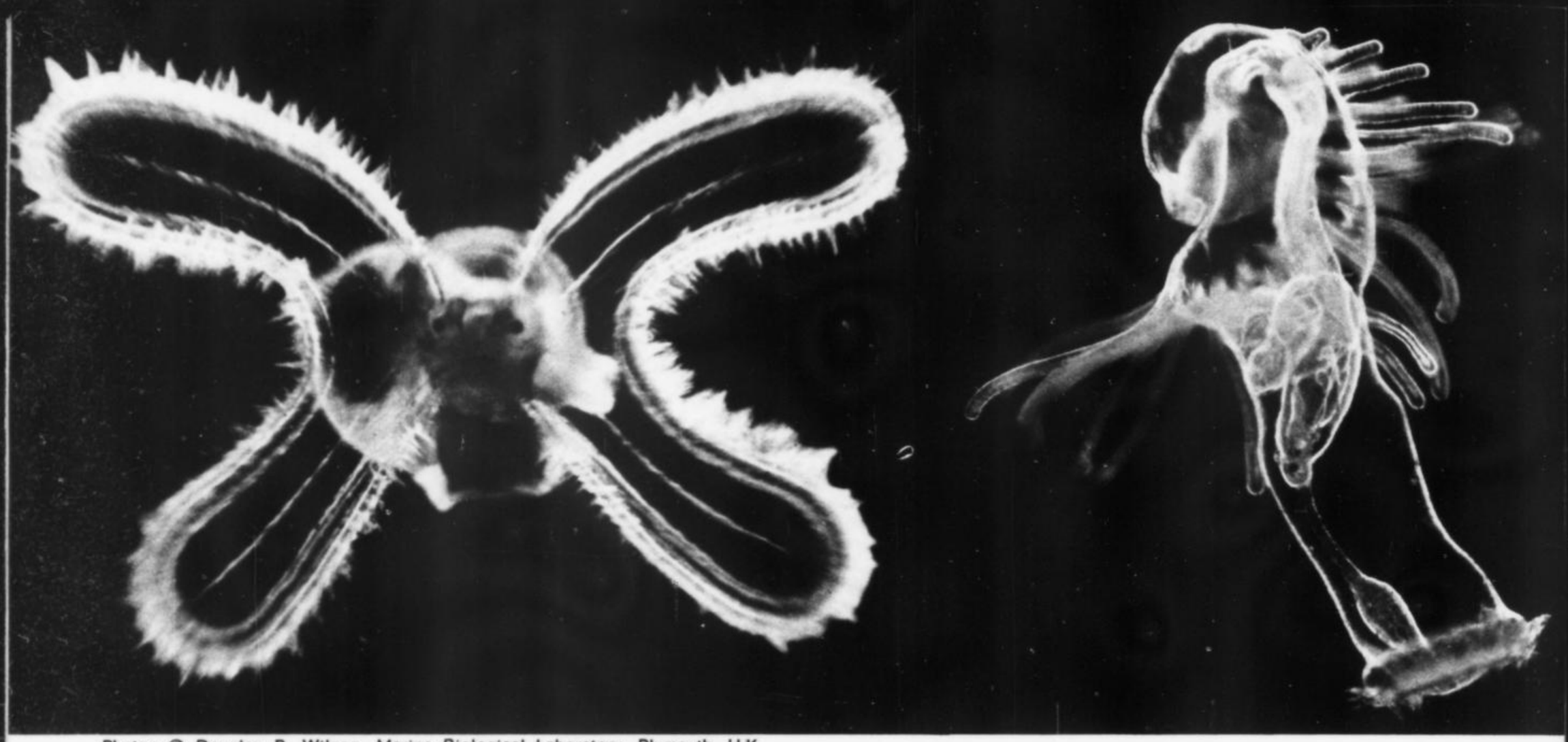
Photo © Magnum - Brian Brake

During long months the lands of South Asia have sweltered under the searing heat. Now, as the monsoon brings relief, a young Indian woman joyfully raises her face to greet the first drops of rain.

Many efforts have been made to find efficient and economical ways of converting salt water into fresh water, but the major obstacle is still the cost of the conversion process. Below right, a giant distillation plant on the Persian Gulf. Research has also been going on to produce rain artificially. Below, scientist produces cloud of ice fog during weather research experiments in Yellowstone Park, Wyoming (U.S.A.).

Photo USIS

Photo © Paul Almasy, Paris



Photos © Douglas P. Wilson, Marine Biological Laboratory, Plymouth, U.K.

EXPLORING THE WORLD'S OCEANS

Man's knowledge of the oceans which cover three-quarters of the earth's surface is meagre compared to their importance to him. The Indian Ocean, for instance, is a "weather generator" for many countries of South Asia and a potentially rich fishing ground. But it was one of the world's least known oceans until an international expedition (25 countries, 40 ships) co-sponsored by Unesco and the Special Committee on Oceanic Research studied it intensively from 1959 to 1965. Today, oceanography is focussed on a systematic global exploration of the world's oceans. Below left, scientists of a Red Sea underwater oceanographic expedition return to their sea-bed base with fish held captive in plastic bags. Above, two of the thousands of species of microscopic marine animals (zooplankton), one of the first links in the food chain of sea creatures from tiny fish to mammoth whales.

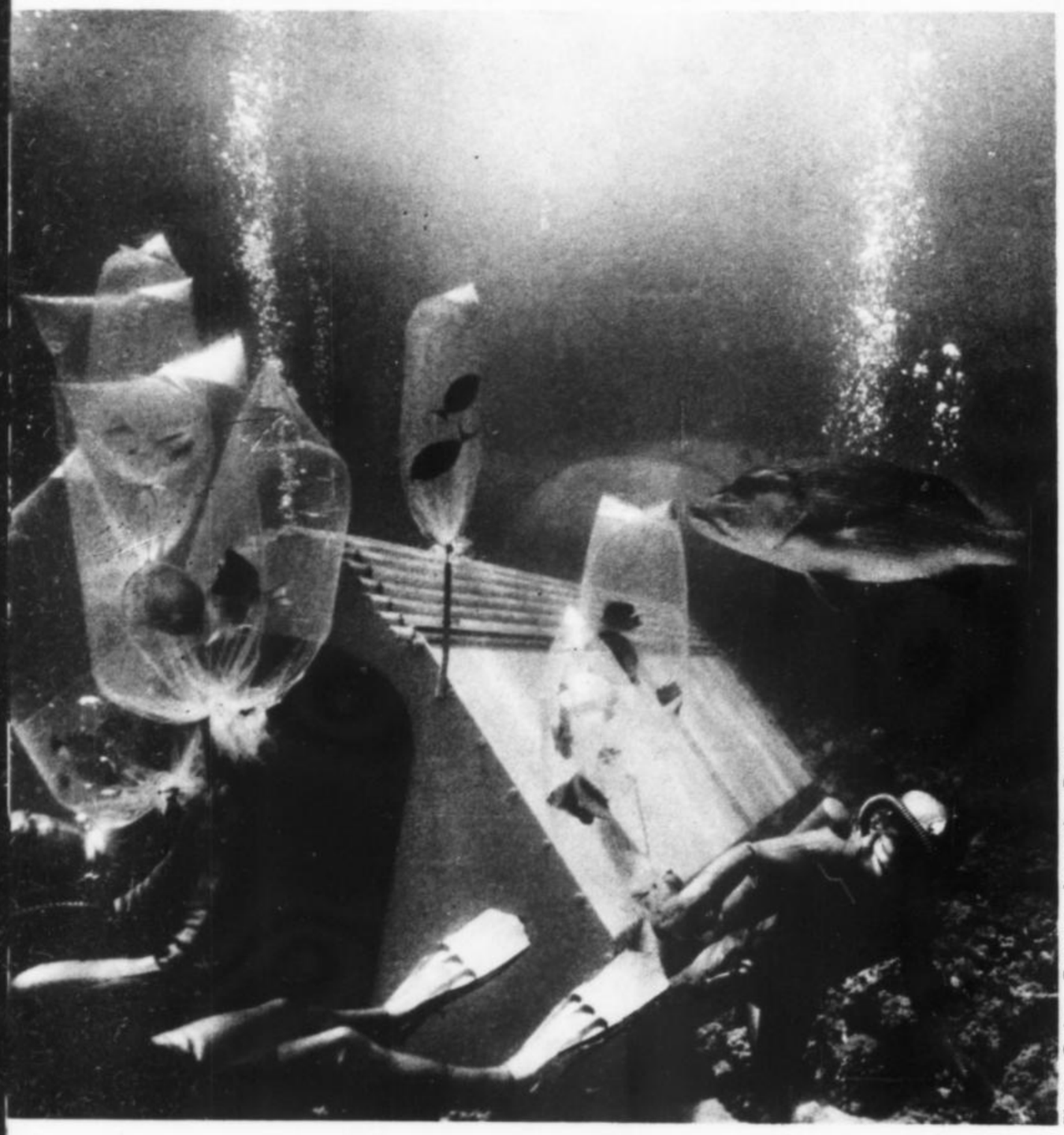


Photo © Les Requins Associés, Paris

Photo © Louis Boutan

One of the first underwater photographs, taken in 1898 by Prof. Louis Boutan of the Museum of Natural History, Paris, with the aid of a magnesium flare.

ROUSSEAU, FATHER OF ANTHROPOLOGY

by Claude Lévi-Strauss

ROUSSEAU was more than just a keen and subtle observer of peasant life, an impassioned reader of books on foreign travel, a skilful and accomplished investigator of exotic customs and beliefs. Without fear of contradiction it can be stated that a full century before anthropology was actually born he conceived, desired and foretold it, placing it directly in the ranks of the natural and human sciences then in existence.

This prophetic conception, which he formulated both as a plea and as a programme of action, appears in a long footnote to the *Discourse on the Origin of Inequality*. "I have difficulty in comprehending," Rousseau wrote, "why in an age that prides itself on learning, two men cannot be found, one of whom would sacrifice twenty thousand crowns of his wealth and the other ten years of his life, to make a historic journey round the world, studying not only the inevitable stones and plants, but for once men and customs."

And a little further on he exclaims: "The whole of the world is a weave of nations of which we know only the names. And we presume to judge mankind!

"Imagine a Montesquieu, a Buffon, a Diderot, a d'Alembert, a Condillac, or men of that stamp, travelling to instruct their fellow-countrymen, observing or describing as only they know how, Turkey, Egypt, Barbary, the empire of Morocco, Guinea, the land of the Kaffirs, the interior of Africa and its eastern coast, the Malabars, the Mogul, the banks of the Ganges, the kingdoms of Siam, Pegu and Ava, China, Tartary, and above all Japan; and in the other hemisphere, Mexico, Peru, Chile, the Magellan lands, not forgetting the Patagonias real or imaginary, Tucuman, Paraguay, and if possible Brazil, the Caribbean, Florida and all the savage lands. Such a journey would be of more importance than all others and would have to be made with the greatest of care.

"Imagine that these new Hercules, on their return from those unforgettable travels, were to write at their leisure a natural, moral and political history of what they had seen, then we would see for ourselves a new world arise from their pens, and we would learn to know our own..." (*Discourse on the Origin of Inequality*, note 10.)

Is this not the very subject matter as well as the working method of modern anthropology?

But Rousseau did not just foresee anthropology, he actually founded it. Firstly, he did so in practice by writing the *Discourse on the Origin and Foundations of Inequality Among Men* which posed the question of the relationship betwen nature and culture, and is perhaps the first treatise produced on general anthropology. Secondly, he founded the science in theory by setting down with remarkable clarity and precision the aims of the anthropologist as distinguished from those of the moralist and the historian :

"When one wishes to study men, one must look close at hand ; but to study man, one must learn to look into the distance ; one must first observe the differences in order to discern the properties." (*Essay on the Origin of Languages*, Chapter VIII.)

This method of approach which Rousseau assigned to anthropology marks the birth of the new science and helps to clarify what at first may appear to be a double paradox: that Rousseau could at one and the same time advocate the study of men living in the most remote corners of the earth, but in effect devoted most of his attention to the one man nearest to him, namely himself; and that in all his writings his systematic desire for identification with others went hand in hand with his total refusal of identification with himself.

Now every anthropologist at some time or other during his life work must resolve these same two seeming contradictions which in reality are no more than the two interchangeable sides of one coin.

Each time that the anthropologist goes out into the field he plunges into a world where everything around him is strange and often hostile. He finds himself alone with nothing but his own person, his subjective self, to help him survive and carry on his work.

Physically and mentally wracked as he is by fatigue, hunger and hardship, by the disruption of his normal habits, and by the sudden revelation of prejudices which he had never suspected to exist, his self reveals itself in these unfamiliar surroundings as it really is—battered and buffeted by all the shocks and impacts of his personal life, which not only affected his choice of a career but would thereafter deeply mark its entire course.

In the work of anthropology, therefore, the observer uses himself as his own instrument of observation. As a result, he must learn to know himself, to look at himself objectively and at a distance as if he were another person. And so the anthropologist turns to this *other* person within him, which is different from his *self*, in order to arrive at an evaluation. And this then becomes an integral part of all the observations he carries out in the field on groups and individuals and the *other* within them. The principle of "confessions", written or unacknowledged, is thus basic to the work of every anthropologist.

For in order to rediscover one's own image as reflected in others, which is anthropology's single purpose in studying man, one should first reject one's image of oneself.

IT is to Rousseau that we owe the discovery of this profound principle—and the only one on which the sciences of man could be founded. But it remained out of reach and grasp and incomprehensible so long as the accepted philosophy was based on Descarte's doctrine of the Cogito (*Cogito ergo sum*) and was fettered to the alleged logical proof of the ego upon which the edifice of physics was constructed though only by renouncing that of sociology and even biology.

Descartes believed that he could pass directly from the interiority of man to the external world, overlooking that between these two extremes there existed societies and civilizations, that is, worlds made up of men.

Rousseau speaks eloquently of himself in the third person as "he" (sometimes even splitting this "he" into two distinct parts as in the *Dialogues*) heralding the famous formula "The me is another" (the anthropologist does the same thing before proceeding to show that other people are men like himself, or in other words, the other is me).

Rousseau thus emerges as the great innovator of the concept of unconditional objectivity. In his first *Promenade*, he defines his aim as "to study the modifications of my soul and their sequels", and then adds: "In a sense, I shall perform upon myself the same

CONTINUED ON NEXT PAGE

CLAUDE LEVI-STRAUSS *is perhaps the world's leading anthropologist today. He is professor at the Collège de France and director of its Laboratory of Social Anthropology.*

experiments that the physicist carries out on the atmosphere in order to discover its daily condition."

What Rousseau reveals to us (and though modern psychology and anthropology have now made it more familiar, it is nevertheless a most astonishing revelation) is that there is a third person "he" that thinks within me, and at first leads me to doubt that it is I who am thinking.

To Montaigne's question "What do I know?" (which started the whole discussion) Descartes thought he could provide the reply with his "I think, therefore I am." To this Rousseau retorted with the query "What am I?" which cannot be answered until another, more fundamental, question has been resolved: "Am I?" And the answer that personal experience has given is the "he" concept that Rousseau discovered and which he proceeded at once to explore with consummate lucidity...

Now if we are to believe that when first human societies appeared on earth man achieved a triple transformation, passing from a state of nature to culture, from sentiment to knowledge, and from an animal-like state to that of humanity (which is precisely what Rousseau set out to prove in his *Discourse on Inequality*) we can do so only by attributing to man in his very earliest primitive condition some vital faculty or quality which impelled him to make this threefold transition.

And we must consequently assume that from the very start this quality latently possessed both contradictory elements at least as attributes if not as intrinsic parts, so that it was at one and the same time both natural and cultural, emotional and rational, animal and human. We must also assume that the transition could be made from one to the other providing this quality became conscious in man's mind.

This quality, as Rousseau repeatedly stated, is pity which issues from man's identification with another—not just a relative or a companion or a compatriot, but with any man because he is a man; and indeed with any living creature because it is alive.

Early man thus began by intuitively feeling himself identical with all his fellow beings. And he never wholly forgot this feeling even when the rise of population forced him to migrate to new lands and to adapt himself to new modes of living, and led him to the awakening of his own identity.

But this awakening came only after he had slowly learned to recognize the identity of others and to distinguish the various animals according to their species, the human state from the animal state, and his own individuality from the individuality of other men.

The recognition that all men and animals are feeling beings (which is what identification signifies) long antedated man's awareness of their differences: first with regard to the characteristics common to all living creatures, and only later to the human as opposed to non-human attributes. It is with this bold conclusion that Rousseau put an end to Descarte's doctrine of the Cogito.

Photo Unesco - Dominique Darbois

Rousseau's thought thus evolved from two principles: identification with another, even the most removed "other" of all others including creatures of the animal world; and the rejection of identification with oneself, that is to say the rejection of everything which might make the self seem "worthy". These two attitudes are complementary, the second actually being the springboard for the first: I am not "me" but the weakest and humblest of "others". Herein lies the true originality of the *Confessions*.

THE Rousseauist revolution, as a forerunner and beginning of the anthropological revolution, lies in the repudiation of forced identifications—either of a culture with its own culture, or of an individual member of a culture with a public figure or rôle which that culture seeks to impose upon him.

In both cases the culture and the individual assert their right to free identification, and this can only be achieved *beyond* man, i.e. with all living and therefore suffering creatures; and also *before* the public figure or rôle, i.e. with a being as such and not one already shaped and classified.

In this way the "I" and the "he", freed from the distinction that only philosophy has sought to encourage, are once again united and merged. With their original unity thus restored at last, they can forge together the *us* against the *them*, that is, against society antagonistic and inimical to man, and which man is the more easily prepared to reject since Rousseau, by his own example, has taught him how to escape the intolerable contradictions of civilized life.

For though it is true that man has been expelled by nature and that society continues to oppress him, he can at least reverse the extremes of the dilemma to his own advantage by *seeking the society of nature in order to meditate on the nature of society*. This, it seems to me, is the lasting message of the *Social Contract*, the *Letters on Botany* and the *Reveries*...

But it is today, for all of us who have come to experience Rousseau's prediction to his readers of "the terror of those unfortunates who will live after you," that his thoughts tower to their full height and reveal the broad sweep of their horizons...

In this world more cruel to man perhaps than it has ever been, charged with extermination in every form, massacre and torture not always disavowed no doubt but comfortably dismissed by us as no longer important since they were confined to far-off people who we were told suffered for our good or at any rate in our name—in this universe of ours become smaller, more drawn together as our members steadily augment and with no fragment of humanity left safe from insidious attack—the anguish of living in society weighs on us all.

It is today, I repeat, because he put civilization on trial, pointing a finger at its iniquities and abuses and denied that these could possibly lead to the exercise of virtue in man, that Rousseau can help us to shatter an illusion the deadly effects of which we are now able alas to observe in ourselves and on ourselves. For is it not because of the myth of the exclusive dignity of human nature that nature itself

suffered its first mutilation, followed inevitably by other mutilations?

Never in the course of the past four centuries has western man been in a better position to realize that by arrogating to himself the right to raise a wall dividing mankind from the beast in nature, and appropriating to himself all the qualities he denied the latter, he set in motion an infernal cycle.

For this same wall was to be pulled steadily tighter, serving to set some men apart from other men and to justify in the minds of an ever-shrinking minority their claim to being the only civilization of men. Such a civilization, based as it was on the principle and notion of self-conceit, was corrupt from the very start.

Only Rousseau raised his voice against this type of egotism. In the footnote to the *Discourse* previously quoted, Rousseau recounts that, from the clumsy descriptions made by travellers, he preferred to recognize the great apes of Africa and Asia as men of an unknown race rather than run the risk of denying human nature to creatures who might possess it.

For the only hope that each of us can have that we shall not be treated one day as beasts by our fellow-men is for all our fellow-men, we first amongst them, to look upon ourselves at once as suffering beings, nurturing within us that faculty for pity which in nature replaces "laws, morals and virtue," and without which, as we are now coming to realize, there can be no law, no morals and no virtue in society.

IT may well be that this teaching was already contained in the great religions of the Far East. But in the traditions of the West where, ever since antiquity, it was thought that one could play a double game and tamper with the evidence that man was a living and a suffering being, no different from all other beings before secondary factors distinguished him from them, who else but Jean-Jacques Rousseau has made this message available to us?

"I have a violent aversion," Rousseau wrote in his fourth letter to Monsieur de Malesherbes, "to social orders that dominate others. I hate the Great, I hate their condition." Does not this assertion apply first to man who has sought to dominate other living creatures and maintain a separate state, thereby giving the least honourable of men freedom to do the same to other men and to take advantage of a notion as disgraceful in this latter instance as it was in the earlier broad context.

In a cultivated society there can be no excuse for the only really inexpiable crime of man, that of considering himself abidingly or momentarily superior, or treating men as objects, be it for reasons of race, culture, conquest, or merely expediency.

— *March 1963*

GEORGES ROUAULT

The painter with a genuine love of his art is a king in his own right—however diminutive his kingdom, however small his stature. He need never abdicate the throne and will leave a happier memory than many a crowned monarch.

— *November 1952*

HENRI MATISSE

I have often asked visitors who come to see me at Vence whether they had noticed the thistles by the side of the road. Nobody had seen them. The first step to creation is to see everything as it really is, and that demands a constant effort.

— *October 1953*

JULIAN HUXLEY

No peace will be permanent unless it is based on co-operation in scientific and cultural affairs. To achieve this will be a long and not always spectacular job, but it is none the less a necessary one. To have reduced the physical distances between countries is of no avail unless at the same time we reduce psychological distances between peoples and nations.

— *December 1948*

Mme LUCE LANGEVIN

One of the greatest contributions of the French Revolution to Europe and to science throughout the entire world was the introduction of the metric system. The first systematic attempts at international scientific collaboration date from the introduction of this system. It was for the purpose of inaugurating the metric system that the first international scientific conferences were held and the first international institutions set up, such as the International Bureau of Weights and Measures, at Sèvres (France), which has been in operation since 1875.

— *March 1962*

FATHER YVES CONGAR

Racialism implies a denial of God, for there can be no God if He is not the Father of all.

— *August-September 1953*

BART J. BOK

The free exchange of information and facilitation of travel are both essential to scientific progress and human welfare, and nationalism in science leads to international misunderstanding and impedes the promotion of world peace.

— *April 1952*

ROBERT ESCARPIT

The appearance of the mass-circulation book is probably the most important cultural development in the second half of the 20th century. What is involved is not the adaptation of books to new conditions but a real revolution. The mass-circulation book is as different from the classic book as was the printed book from the manuscript and the manuscript from the clay tablet. The revolution in books will eventually modify the contents of books themselves as it is already transforming the relationship between author and reader.

— *September 1965*

ATHELSTAN SPILHAUS

Much of the undersea landscape hidden from our eyes is less well-known than the face of the moon that we see. With minerals resting on it, nutrients sinking towards it, geological history locked in its sedimentary layers and petroleum beneath it, the sea's bottom is at least as interesting, and certainly more immediately useful to man, than the moon's backside. What we need to do to investigate the sea can be done for a yearly cost which is a small fraction of what we now spend on space.

— *July-August 1960*

TIBOR MENDE

A new approach to land reform in Latin America could be a decisive factor in reviving and modernizing Latin America's agriculture, giving it support rather than lagging behind in industrial development. Such a new approach might herald Latin America's final offensive against her intolerable heritage of rural poverty, malnutrition and famine.

— *June 1961*

ALAIN DANIELOU

The problem today is how to safeguard some intensely precious aspects of cultural life associated with peoples who, because they are temporarily less prosperous economically than the countries of the west, are too often lumped together as "under-developed" when more often than not the reverse is true.

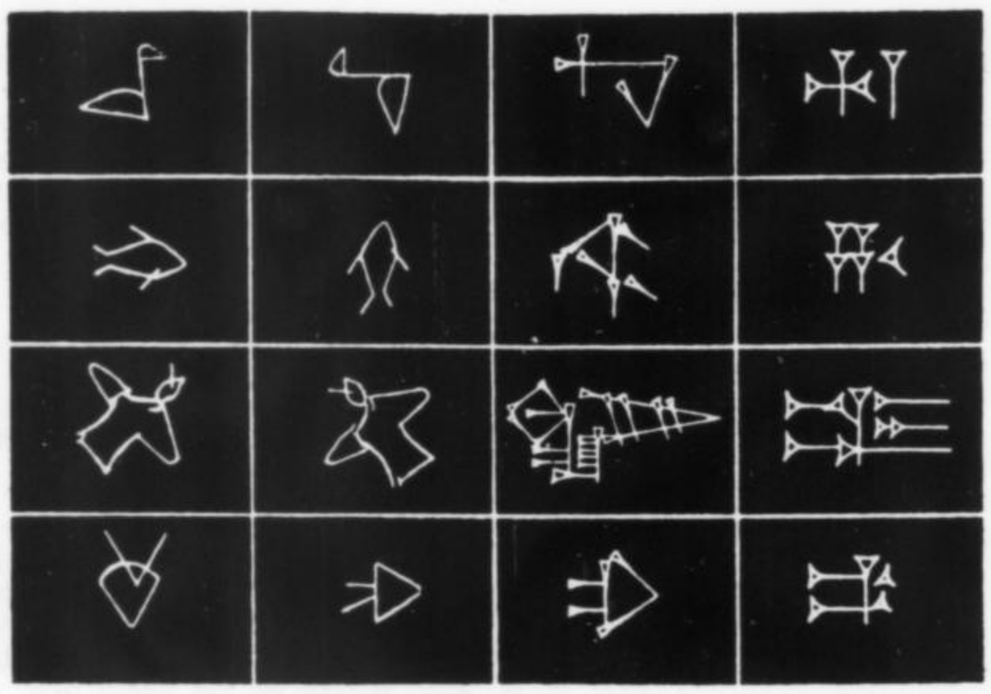
— *June 1962*

MARGARET MEAD

Continuing education throughout life has become a necessity in almost every field of life from house-keeping to atomic physics.

— *January 1961*

How some Sumerian pictographic signs developed into cuneiform script. The word is first represented by a drawing. This turns on its side, then becomes schematic when written with a stylus on a clay tablet, and finally, in an abstract form, becomes an efficient syllabic method of writing. Thousands of tablets and texts have been discovered on sites in Mesopotamia and deciphered. Right, from top, signs originating as a bird, a fish, a donkey and an ox.



From "A Study of Writing" by I.J. Gelb, University of Chicago Press, 1963

CUNEIFORM SCRIPT BORN FROM THE POINT OF A REED

The Sumerians in Lower Mesopotamia rank with the Egyptians, the Cretans and the Chinese as the earliest inventors of an efficient system of writing. They took the first step from the pictographic to the syllabic system and thus helped to develop writing as we know it today. About 3000 B.C., the Sumerians made seals, used as property marks, and then employed word-signs picturing the object referred to. These original "pictographs" were then given phonetic values resulting in a greater descriptive precision. This was now a "rebus-writing", a word that was difficult to render pictorially being shown by the sign for another word with the same or similar sound. It thus became possible to write almost any combination of spoken words. By 2500 B.C., the writing had evolved into a few wedge-shaped strokes from which the name "cuneiform" is taken. It was written on tablets of damp clay with a stylus—often the sharpened point of a reed. Babylonians and Assyrians—and later the Hittites and Persians—took over the cuneiform script from the Sumerians and adapted it to their own languages. Sometimes an explanatory picture was included in the writing to guide the illiterate. But pictures and script now had no need of each other. Reading and writing began to spread throughout Mesopotamia.

MYSTERY SCRIPTS

One of the great advances in archaeological research in the 19th century was the decipherment of many ancient languages. Before 1822, not a word could be read of the hieroglyphic system of writing of the Egyptians, one of the earliest used by man. But that year the code was cracked, and now documents covering three millennia of civilization have become an open book. The cuneiform scripts of the Sumerians, Babylonians and Assyrians were all deciphered during the 19th century. Our own century has seen the decipherment of two more cuneiform scripts, (the Ugaritic script of Ras Shamra, Syria, and that of the Hittites) as well as the Hittite hieroglyphic script. In 1953 came the decipherment of Minoan Linear B. To all these results scholars in many countries have contributed. It is to be hoped that with the tools of modern science, the remaining "mystery" languages will one day find their decipherers.

— March 1964

THE UNDECIPHERED DISC FROM PHAISTOS

Photo © Michel Audrain - Editions Arthaud, Paris

In 1908 an Italian mission working at Hagia Triada, near Phaistos, in Crete, brought to light a script of which only one example exists. It was inscribed on a flat terra-cotta disc about six and a half inches in diameter (left) which was found in an outbuilding of the Minoan Palace. Next to it was a broken tablet inscribed with the Cretan Linear A script that has been dated to about 1700 B.C.

On either side of the terra-cotta disc is a text impressed with a hitherto unknown form of hieroglyphics arranged in bands spiralling to (or from) the centre. The signs, which seem to have been stamped by means of 45 different wooden and metal punches, number 241 in all and are divided into 61 groups of characters (which might represent words or sentences) separated by vertical lines. The script is considered to be a syllabic one: there are too few characters for a pictographic script and too many for an alphabetic one.

Archaeologists and classical scholars have been trying, right from the start, to decode this script on the basis of internal evidence.

The main difficulty is that no-one knows what language the text was written in—it has been variously adjudged to be Philistine, Lycian, Carian, Greek, Cypriote, Libyan, Anatolian and Semitic—or even whether it was written from right to left, or the reverse. J. Chadwick, of Cambridge University, the collaborator of Michael Ventris in the decipherment of Minoan Linear B, took the latter view. He drew particular attention to the use of punches, and described it as a remarkable anticipation of the invention of engraving and printing. It was hard to believe, as he pointed out, that the preparation of the set of 45 punches would have been undertaken solely for the production of one disc. Thus, companion pieces may one day be found.

Some examples of the results achieved by would be decipherers give an idea of the hazards involved. An English investigator, in 1931, took the language to be Greek, ascribing to each character a syllabic value. Thus one five-character group was translated as "Arise, Saviour! Listen, Goddess, Rheal!" A Greek scholar favoured Semitic, and produced a partial "rendering" in 1948: "Supreme - deity, of the powerful thrones star; Supreme - tenderness of the consolatory words; Supreme - donator of the prophecies; Supreme - of the eggs the white..."

BIRD OF PARADISE.
Arabic characters form the fanciful impression of a nightingale (right). This 19th century Arabic calligram is a quotation from the Koran promising entry to Paradise to those who do good during their lifetime.

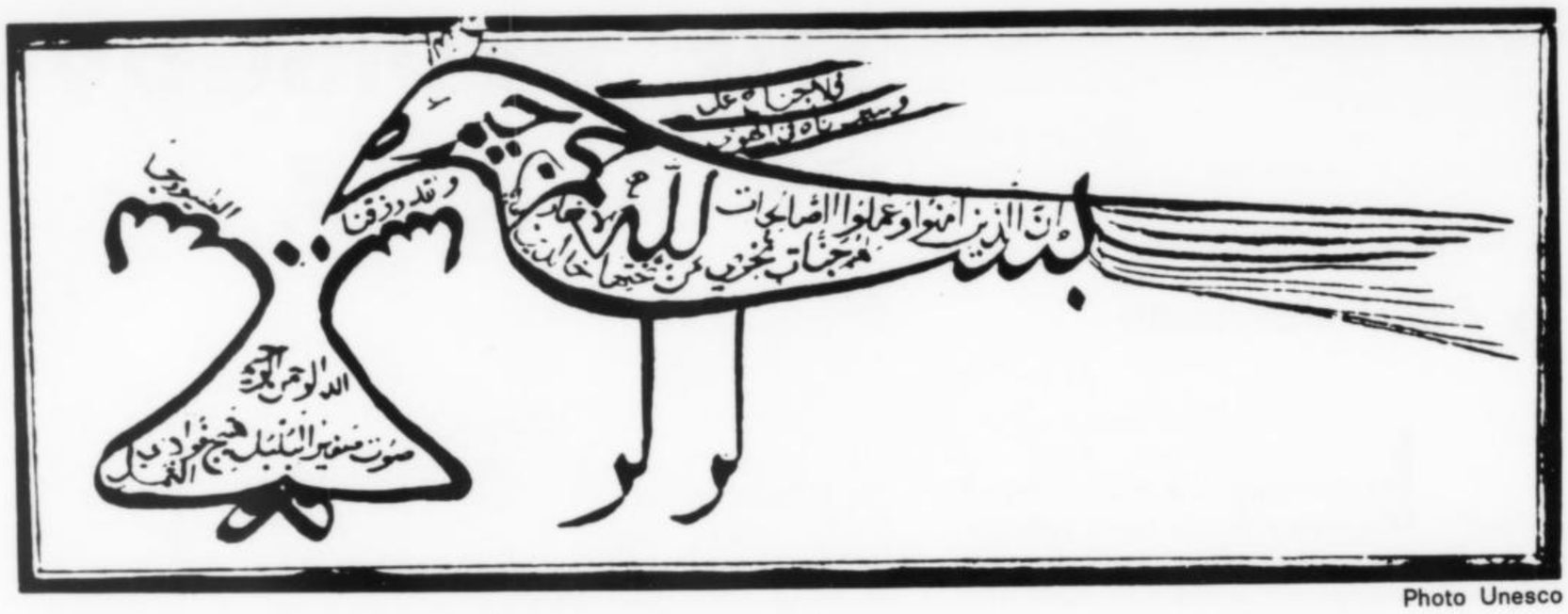


Photo Unesco

BESTIARY of elephants, tigers and rhinos intermingles with mythological characters and inscriptions thus far undeciphered on seals made by the ancient peoples of the Indus Valley. Plaques and seals, dating back some 5,000 years, attest the use of writing by this remarkable civilization, whose chief cities were Mohenjo-daro and Harappa (today in West Pakistan). Below, enlargement of an Indus Valley seal.

Photo Archaeological Seminar of the University of Halle

THE REDISCOVERY OF AFRICA

by Basil Davidson

IS the Negro a man without a past? Not many years have passed since the outside world took an affirmative answer more or less for granted.

But now, in the wake of the colonial hurricane, there emerges a new approach to the whole question. It is increasingly realized that the cultural contributions of African peoples to the general history and progress of mankind were not limited to interesting works of art, whether in wood or ivory or in bronze or gold, but comprehended a wide range of political and social achievements that were no less important or remarkable because they were ignored or little known.

It is seen, indeed, that these works of art that so many Asians and Americans and Europeans have admired were not the more or less mysterious products of a social vacuum, but, on the contrary, the ornament and attribute of early African civilizations.

These middle years of the 20th century may be remembered for many troubles and upheavals, and for risks and dangers greater than any that humanity had ever run before: on the side of good they will also be remembered as the central years of African emancipation. And they mean, of course, much more than a purely political emancipation; they mean, as well, an intellectual and moral emancipation, a breaking down of obstacles that have stood between Africans and a sense of full equality with the rest of the world, and of barriers that have helped to isolate these African peoples from the general family of man.

Homo sapiens may first have seen the light in central or east Africa. For some thirty years now, Africa has yielded discovery after discovery revolutionizing earlier concepts of the remote origins of humanity.

What now becomes possible is to sketch the outline of the comparatively *recent* pre-history and history of large regions of Africa: the record, that is, of the pre-medieval and medieval centuries that came immediately before European contact and penetration.

It is this that is really new—this assertion that Africans went through successive, distinctive, and knowable phases of growth and development in the fifteen or twenty centuries before the European records of Africa became frequent and various. Reassessment of the African past, in the sense that I have spoken of, is essentially the unravelling and writing of the history of the African Metal Age in the lands that lie to the south of the Sahara desert.

Late Stone Age peoples on the lower reaches of the Nile, and in nearby regions that were much more fertile then, thrust their way into history in about 3000 B.C., when the "first dynasty" of the Pharoahs took power in the delta of the Nile. This great forward step in northernmost Africa, interwoven with the comparable achievements of peoples in the Near East and the Mediterranean, acted and reacted as the centuries went by on lands to the south and west.

Its influence spread southward up the Nile and there, reacting on the peoples that it found, stimulated and helped to create the civilization of Kush—of that renowned kingdom of Napate and Meroe whose kings and queens would rule in more or less continuous succession for a thousand years after about 800 B.C.

Its influence also spread westward along the southern shores of the Mediterranean: Phoenician Carthage, founded in the ninth century B.C., helped to stimulate and create the Libyco-Berber civilizations of northern Africa. And, thirdly, these ancient civilizations of the Near East and of Egypt produced in the southernmost tip of Arabia—that Arabia of the Queen of Sheba whom Solomon knew and loved —another region of high civilization; and from southern Arabia this civilization of antiquity despatched its settlers and traders and warriors across the Red Sea into the Horn of Africa, and its mariners and colonists down the long east coast of Africa.

These pioneers and their mastery of metal-working and of other material techniques did not move into a void. They moved into a land that was peopled then, if thinly, by several branches of the human family to which anthropologists have awarded the names of Bushman, Negrillo, Hottentot, Negro, and Hamite.

Now the origins of these peoples of continental Africa are obscure and confused. They too, apparently, had moved southward across the continent, coming perhaps from outside it, in centuries beyond calculation.

Perhaps the Hottentots—the natives whom the first Dutch settlers would find at the Cape of Good Hope in 1652—arrived some time after about 5000 B.C.—but nothing of this is clearly known—the peoples whom we know as Negro and Hamite began to emerge, multiply, and follow the earlier migrants in a generally southward direction.

As they wandered across the continent these later peoples, often mingling with earlier peoples whom they found, worked out new ways of living. They invented tropical agriculture. They began to settle and raise new crops. They learned how to smelt natural copper and make primitive tools and weapons of this metal.

AT a time that was shortly before or after the beginning of the Christian era these peoples of the southern continent began to mine and smelt iron, and to make more efficient tools and weapons; and with this they acquired a new and, as it would prove, revolutionary control over the material environment in which they lived. It is from about this time—from about 2,000 years ago—that the peoples of the continental heart of Africa begin to multiply and form their present major groupings.

It is from then, as it seems, that the largest of all of Africa's existing human groups begins to spread into and populate the empty or near-empty forests and savannahs. This group is called the Bantu; but the term has little or no racial significance, being a linguistic term for all these many peoples who speak a closely related language.

Racially the Bantu are the product of intermingling over long periods of time between Negro and Hamite and Bushman and Hottentot. Physically, therefore, they vary greatly among themselves; but all their languages go back, more or less obviously, to a common root. We do not know the origins of this root.

Thus it is the last 2,000 years, more or less, that emerge as the formative period of most of the peoples of continental Africa. This is the period of their Iron Age. Some authorities prefer to call this their Metal or Palaeometallic Age, because, although knowledge of ferrous metallurgy was

BASIL DAVIDSON, *British author and journalist, has written widely on African affairs.*

Photo © Dominique Darbois

the decisive influence, African peoples also knew the working of several other minerals, including gold and copper and tin. In time, too, some of them worked extensively in brass and bronze; but they never knew, as ancient Asia and Europe had known, a Bronze Age that made a long distinctive period of development before their Iron Age.

Now it is in studying this Metal Age —or, more narrowly, the fifteen or sixteen centuries before European contact along the coast—that present research is principally and dramatically engaged. Advancing along three different but related lines, history and archaeology and anthropology now begin to bring their findings together and to offer a coherent picture that was invisible only a handful of years ago.

New translations are being projected or prepared of several classic works, such as the first century A.D. *Periplus of the Erythraean Sea* (in Britain) and the 16th century writings on the Western Sudan of Leo Africanus (in France). The Central African Archives (of the Federation of Central Africa) is collaborating with Arquivo Historico de Mozambique in the editing and publication of some 15,000 hitherto unpublished documents from the libraries of Goa, Lisbon, and the Vatican; and these should throw much new light on early European contacts.

Joseph Needham, in his monumental study of the history of science in China, has meanwhile devoted part of his sixth volume to Chinese maritime technology, and, in so doing, has shown how great was the Chinese contribution to that Indian Ocean trade which had its western terminals on the East African coast.

IN the past few years, African archaeology has had important successes. Mauny and Thomassey have gone far towards completing the excavation of the ancient city of Kumbi Saleh, probable site of the capital of medieval Ghana. J.P. Lebeuf and Annie Masson-Detourbet have uncovered the remarkable bronze-using civilization of the Sao people of early medieval Chad. Jean Vercoutter, in the Sudan, has completed a preliminary list of sites of the imposing civilization of Kush. Other French specialists have continued the investigation of early Ethiopia.

In East Africa, Gevase Mathew and G.S.P. Freeman-Grenville have listed ancient and medieval sites on the coast of Kenya and Tanzania, while J.S. Kirkman has excavated the late medieval ruins of Gedi, near the Kenyan port of Malindi. Further to the north, in Somaliland, Enrico Cerulli and Vinigi Grottanelli have thrown important light on early settlements and migrations on the coast and coastal islands.

Coins and durable imports such as china offer hopeful means of dating these many stone ruins of the coast and interior. "I have never in my life," remarked Sir Mortimer Wheeler, the British archaeologist, after a fortnight's visit to Tanganyika in 1955, "seen so much broken china as I have seen in the past fortnight along the coast here and the Kilwa Islands: literally, fragments of Chinese porcelain by the shovelful... In fact, I think it is fair to say that as far as the Middle Ages are concerned, from the tenth century onwards, the buried history of Tanganyika is written in Chinese porcelain."

To the southward there is fresh effort at uncovering the story of another great complex of stone ruins—forts and huts and vast hillside terrace systems —that stretch over several thousands of square miles in Southern Rhodesia and neighbouring lands. Roger Summers has lately completed an initial survey of the stone ruins of Inyanga on the Rhodesian-Mozambique border; and now, with Keith R. Robinson, is working on the foundations of the great walls at Zimbabwe in the hope of finding out whether those tall ruins were built on the site of a previous and more humble culture, or whether the first settlers were also those who built so well in stone.

We are only at the beginning of this search for the history of pre-medieval and medieval Africa. Beyond the barriers of ignorance we may glimpse an historical landscape that is thick with cities or strong stone settlements and loud with the din of ports and ocean-going shipping, that glitters with old armies and the pomp of states and empires and is restless with the rise and fall of dynasties and powers. But at present we can only glimpse at this.

This great task of unravelling the African past remains, and must remain, an international endeavour. Occasional conferences on African pre-history and history have proved, over the past few years, how much can be gained from the pooling of knowledge and the wide discussion of problems. They have stimulated public interest, and helped to create an atmosphere that is favourable to more intensive research. It is to be hoped that they are only the forerunners of many others of their kind. To this end, indeed, Unesco can powerfully contribute.

— *October 1959*

EDITOR'S NOTE : Unesco is now engaged, in the preparation of a General History of Africa which will take several years to complete. The History is being written under the leadership of Prof. K. Onwuka Dike, former vice-chancellor of the University of Ibadan, Nigeria.

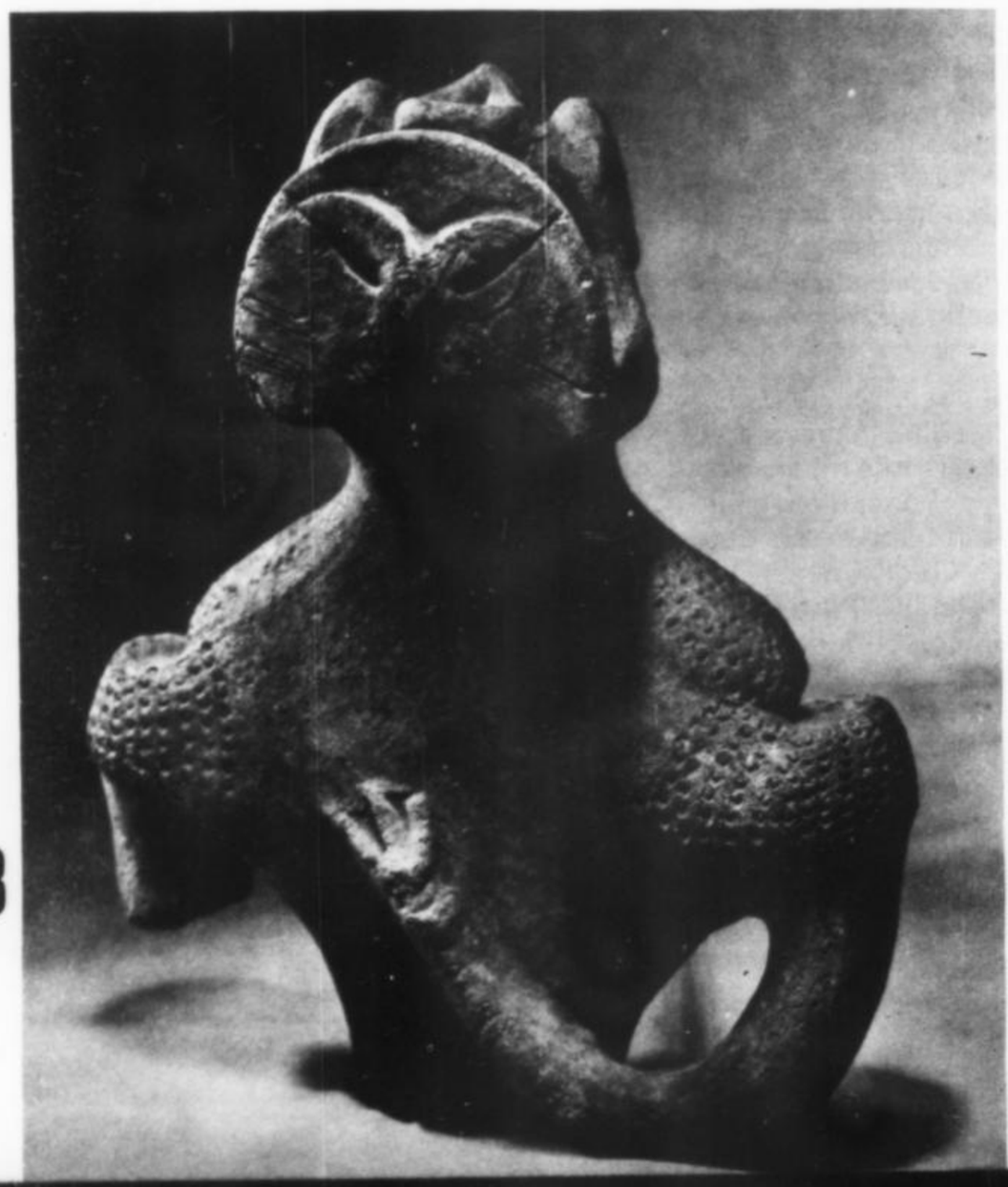
MASTER-WORKS OF STONE AGE JAPAN

Archaeological excavations in Japan have uncovered two remarkable types of ancient clay sculptured figures. The oldest are the "Dogu" clay images which date from as far back as 3000 B.C. They have squat bodies, flattened heads and vigorous expressions and may have been used as a kind of family icon by Japan's Stone Age hunters and fishermen. More recent are the "Haniwa" terra-cotta figurines produced from the third to sixth centuries A.D. They were placed in circles on the slopes of burial mounds, hence their name (Hani= clay, wa = circle). When made for the tombs of men of rank, the Haniwa were often mass produced, most of them being cylinders to surround the burial mound. Hundreds and sometimes thousands were needed and were made rapidly by clay workers normally engaged in making earthenware vessels. The Dogu and Haniwa figures have a remarkable vigour and freshness.

— *June 1958*
SEIROKU NOMA

Photos © M. Sakomoto, Tokyo

Haniwa clay figures, right, modelled in Japan nearly 2,000 years ago show men and women dancers. Placed around ancient tombs, Haniwa figures include animals, such as the monkey, below right, houses and furniture. Below, a striking figure, one of the oldest existing sculptures found in Japan. Such figures were venerated and hung in the primitive dwellings of Stone Age Japan.



THE FORBIDDEN DIALOGUE

by Lewis Nkosi

THE profoundest, most compelling impulses of South African society have always been, and still are, toward amalgamation. This is perhaps the fact least frequently noted about South Africa even by those most opposed to the doctrine of apartheid; but it is a fact which I think ought to be set down straightaway not only because it is true and evidence can be adduced to support it, but because a great deal of the legislative programme of the Nationalist Party Government since 1949 cannot be properly understood without taking this fact into account.

It has also become fashionable in writing about South Africa to emphasize the incompatibility of black and white interests; yet left to their own devices the races have always tended to move closer, albeit unconsciously, toward some form of integration.

Surely the most glaring proof of this fact lies in the economic sphere; but less obvious is a similar impulse at work in the social sphere, which, however denied and deeply buried, continues to reaffirm itself and to agitate toward complete expression.

That the blacks suffer untold hardships as a price for the maintenance of the policy of apartheid is a fact that cannot be denied even by the proponents of apartheid.

What is not always noted is that, though economically exploitative as a ruling class, the whites are also subject to certain very real deprivations as a result of their determination to live by a policy which would seem to all reasonable men not only unrealistic but insane.

To say the very least, South African whites are the most culturally deprived community in Africa. Emotionally they are just as stunted.

They not only grow up denying their innermost dreams, they also learn to do without some of the best works of modern world culture (in literature, music, painting and intellectual discourse) either because such works are considered subversive, or because traffic in culture with the outside world is rendered almost impossible by the maintenance of the policy of apartheid.

It must be remembered that a great number of people active in the cultural area are either non-white or white people strongly opposed to a doctrine of apartheid. Thus the white community in South Africa is becoming almost as isolated in its privileged position as are the blacks without privileges; for not only must the blacks not see Harry Belafonte with a white girl in his arms in "Island in the Sun" but the whites must not see Tony Curtis chained to Sidney Poitier in the film, "The Defiant Ones".

Indeed, a great number of modern works of the best kind in the post-war cinema are kept out of the Republic of South Africa. The banning of books and plays thought to be controversial is too well-known to need reiteration. Under these circumstances it would be surprising if the growth of an indigenous South African culture was not hampered and it would be surprising indeed if the fostering of standards on a par with the rest of the world was not made almost impossible.

It seems to me that both black and white writers are severely impoverished by the limitations as well as the schism existing in South African national life.

For a black writer too much of his emotional response is absorbed into formulating his attitude toward apartheid or finding his place in the revolutionary struggle; no matter where he goes later on and no matter how bored he is with politics he cannot be free of the tragic burden of South Africa until that country has freed its 14,000,000 non-whites.

IT seems to me that the blacks in South Africa, no matter how deprived economically or politically, have a graver, far more responsible attitude toward life. Where white South Africans must manufacture dreams and fantasies in order to maintain some equilibrium between what they really are and what they think they are, the blacks have to learn quite early to strip themselves of every illusion.

We all know what happens to people who cannot face up to the reality of their lives, who must live by evasions and fantasies; a greater burden is placed on writers or any other kind of artist who belongs to such a community. Before they go on to create anything of value they must make an extraordinary effort to unlearn everything they have been taught.

In South Africa, they must, for instance unlearn what they are taught in schools: that the whites, from their forefathers to the present generation, are all heroes, that the whites have the monopoly on moral wisdom and intellectual enterprise; the pain and the anguish which attends the creative efforts of Afrikaans writers at the moment is not a matter for cynical amusement. It is an agony of creative artists who must break through a sealed cocoon in order to see the world in its variousness or even to say something remotely relevant to their country.

Black writers do not have to make any comparable moral choice; they do not have to choose to oppose a system which is patently contrary to all observable reality; their colour makes the choice for them; what they have to do is learn to survive the system.

There are times when an affirmation of certain traditional African values proves exasperatingly difficult for black writers since most of them are reacting to an ideology which asserts again and again that black and white people are irreconcilably different; that the African mind cannot grasp certain nuances of European thought; and, concluding from the foregoing, that apartheid is justifiable, indeed, the only realistic policy to follow.

The result has been that black intellectuals in South Africa have had to bend over backwards to prove that they can not only master the modes of European thought but that they can beat the South African whites at their own game.

Urban African music seems to me to have provided the only example of what South Africa can offer culturally if she were left to develop in a natural direction.

Music, because it is non-literal, is not subject to the same limitations as literature; it is hardly banned; also it is less self-conscious in the modes it adopts to express the agony of the South African situation. The result has been that popular urban African music has provided a glaring paradigm of what is happening to the underground life of the nation.

The music is predominantly African, which is as it should be, considering the dominant numbers of Africans in the country; but it is also eclectic; it provides a moving illustration of cultural diffusion in that part of the continent which offers us the best laboratory for the marriage of African and European techniques and for the coming together of European and African modes of expression.

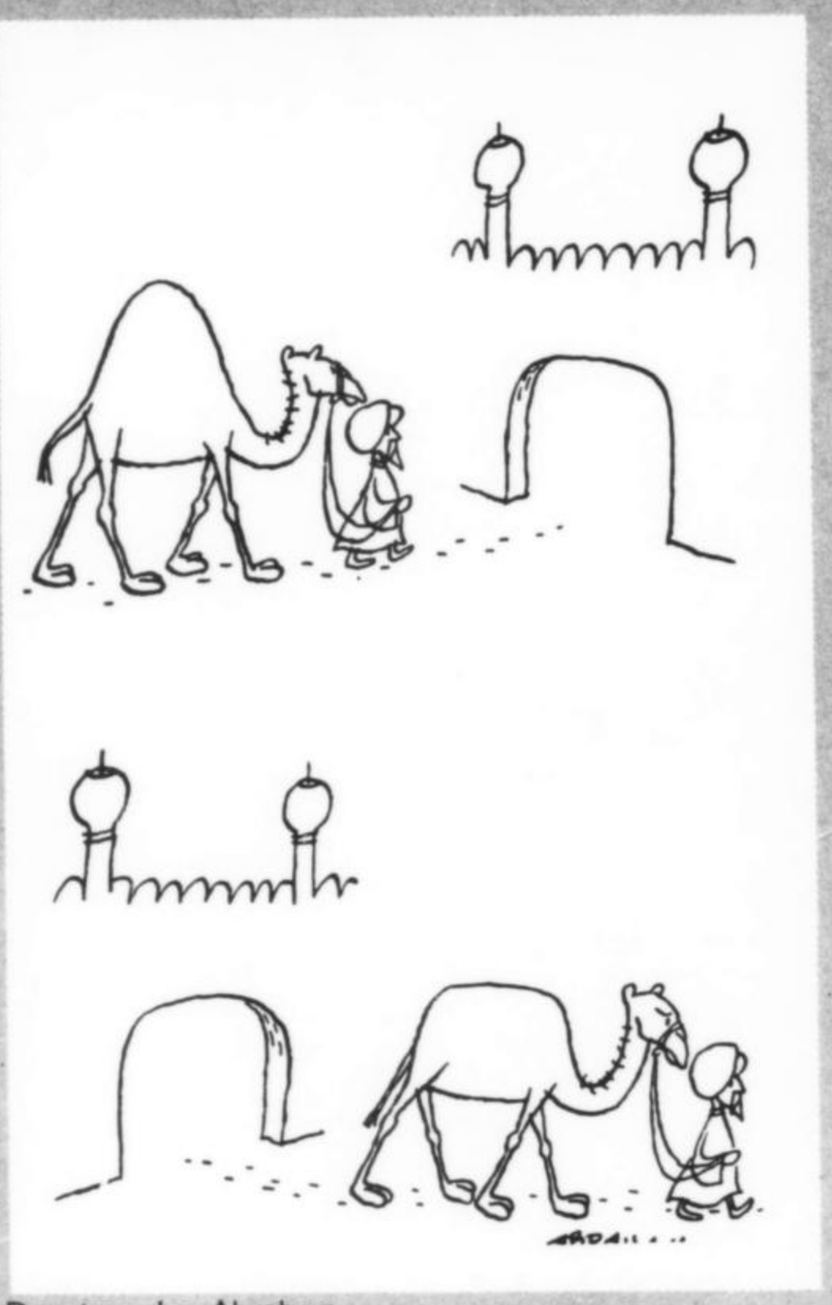
While black literature from the Republic offers us glimpses into an appalling situation of rare brutality and anguish, the music not only shows us this but goes further to affirm what we should have known all along; that the oppressed in South Africa also display an amazing form of resilience, emotional certitude and optimism. On the other hand, apartheid deprives white South Africans of any real participation in such robust forms of cultural expression.

— March 1967

LEWIS NKOSI *of South Africa was exiled by the South African Government in 1960. He is now consulting editor of "The New African", published in London.*

Photo Unesco - Rex Keating

Deprived of water, a camel can lose 100 kilogrammes in 8 days, but regains the weight by drinking 100 litres in 10 minutes.



Drawings by Abraham

THE CAMEL, FACTS AND FABLES

LEGEND has it that the camel can cross the most scorching desert without water or food. Until recently; many common questions could not be answered by science, such as: How long can a camel go without water? Does the camel store water in its body? What is the function of the camel's hump?

It was therefore natural that Unesco, among other institutions, supported an expedition to find answers to many of these problems. Our field studies were carried out in the Algerian Sahara, at Beni Abbes, in 1953-54.

How long a camel can live without drinking water depends on external conditions: amount of food eaten and its water content, the load the camel carries, how far it travels, temperature, and also the breed of the camel and its condition. One therefore cannot say that any camel can do without water for a certain number of days.

We soon found that camels grazing in winter were usually not watered at all. If it rains the desert vegetation contains a good deal of water. We examined a number of such camels. After being without water for one of two months they showed no interest in water whatsoever.

However, in dry winters the camels would undoubtedly have to be watered. To find out how much water a camel needs we fed them dry hay and dry dates for periods of up to 16 days in January. After this, they were rather thirsty but in no serious condition. Each camel lost weight corresponding to the amount of water used up. After 16 days it drank an amount corresponding to the expenditure, bringing the body weight back to normal.

In summer we kept a camel without water for eight days and it lost 100 kg. When allowed to drink it consumed 103 litres of water in 10 minutes. Another camel was without water for 17 days. Both animals lost their appetite, looked thin and emaciated, the muscles were shrunken and the legs scrawny. They would not have been fit for heavy work or long distance travel.

These two camels were exposed to the hot desert wind and sun but they had not worked. Judging from this experiment, even the best camels could not be used for desert travel without water beyond a week in summer.

Many travellers have suggested that the water tolerance of the camel is explained by a storage of water in the stomach or other parts of the body. We observed no instance in which a camel drank an excess of water that could be regarded as storage. The belief comes from the fact that the camel has a stomach divided into several compartments, the largest of which is the rumen containing the coarsely masticated fodder.

The camel's rumen contains large quantities of fluid but so do all ruminants. We analyzed this fluid and found that although it is rather unappetizing it could very well be used for drinking in an emergency. Thus the tale of the Arab who saves his life by killing his camel to drink the water in its stomach may be true. The mistake is in implying that the fluid is stored water.

Some people have stated that the camel's hump contains the camel's water reservoir. But the hump is almost exclusively fat and is an energy storage as it is in other animals. Although the hump does not contain water, there is a grain of truth in the belief that the camel gets water from the hump. Whenever organic material is burned water is formed in the process.

When man is exposed to the hot desert he avoids a rise in body temperature by sweating. The camel also regulates its temperature by sweating but can vary this temperature and save on the amount of water needed to keep cool. It allows its body temperature to rise slowly until almost 41 °C. without losing much water. During the cool night it gives off heat so that its morning temperature may be as low as 34 °C.

The camel can tolerate losing as much as 30 per cent of its body weight during water deprivation in the hot desert. A camel that has lost 50 litres of water (20 per cent weight loss) reduces its blood volume less than one litre. The rest of the water comes from the tissues and tissue fluids. This places the camel in a much better position than other mammals in which thickening of the blood is the main cause of explosive heat death.

— *August-September 1955*

BODIL AND KNUT SCHMIDT-NIELSEN

Photo © Bibliothèque Nationale, Paris

THE ROYAL HIGHWAY OF THE INCAS

Indians leading llama caravans laden with gold along the great Inca Highway in the Andes. An engraving made shortly after the Spanish conquest.

by
Jorge Carrera Andrade

THERE are many paradoxes in history, and one of the strangest is surely that the Incas, who had never heard of the wheel, should have built the greatest road system the world has known. Their network of highways covered some 10,000 miles, stretching from Colombia all the way to Chile and from the shores of the Pacific to jungle forests of the Amazon, criss-crossing almost all the territory now included in the Republics of Ecuador and Peru, as well as portions of Bolivia, Chile, northern Argentina and southern Colombia.

The Inca Empire began as a tiny kingdom on the shores of Lake Titicaca about the year 1,000 A.D. For five hundred years it grew and expanded until, after conquering the Kingdom of Quito, it was the most powerful civilization of South America and adopted the name "Land of the Four Quarters of the World" (Tahuantinsuyu) to signify its control of the four cardinal points of the compass.

JORGE CARRERA ANDRADE *of Ecuador is a leading poet and author of Latin America.*

The Inca road system was built to preserve the unity and safeguard the economic life of the Empire. Its construction is one of the wonders of human history, defying all natural obstacles in one of the most rugged terrains existing anywhere in the world. Though far less known than the celebrated roads of Rome and other ancient empires, the Inca highways are in many ways even more remarkable.

The backbone of the network was a broad highway—the "Great Royal Road of the Incas"—running the entire length of the Inca Empire from north to south, between the two branches of the formidable Andean mountain range. In certain places the road rose sharply to as much as 15,000 feet; in others it dropped steeply in mountain valleys and gorges, traversed broad fertile plains and bleak stretches of desert wasteland.

From the main highway branch roads cut through the mountains in all directions, especially to the west, where they linked up with another mighty highway known as the "Coastal Road", which ran parallel to the Great Royal Road along the sandy coastal plains and forests from Tumbez to the north of Chile where it joined up with it.

It should not be imagined that the Inca roads were mere mountain tracks or desert trails. The Great Royal Highway was 25 feet in width and ran straight as an arrow, without curves or detours of any kind, for 3,000 miles—more than the distance between Gibraltar and Moscow! Paved with stones along almost its entire length, it traversed only the principal cities of the empire, like Cuzco and Quito, the other towns being linked up with the Royal Highway by secondary roads.

On both sides of the highway the Incas built walls of stone and packed earth on top of which they planted agave cactuses at regular intervals. In addition rows of trees lined the road to provide shade for travellers. Living in a bleak landscape the Incas attached great importance to their trees and the empire enacted stringent laws for their preservation. The penalty for cutting them down was death.

ALONG the side of the Great Royal Road ran a rivulet of fresh water to quench the thirst of both wayfarers and draft animals. At intervals of about twelve miles along the entire stretch of 3,000 miles there were wayside houses known as *tampus* where travellers could rest or spend the night. There were also chains of granaries and royal depots stocked with food and all kinds of supplies for the army, including clothing and leather footwear. Grain and manufactured products were stored in huge earthen jars. Strangers were accommodated with the utmost hospitality in hostelries called *corpahuasis* and were provided with food and drink free of charge.

Every mile or so along the Royal Route the Incas built edifices for a special category of imperial functionaries, the *chasquis* or relay couriers, who raced on foot from one end of the kingdom to the other bearing royal messages by word of mouth. Sometimes messages were conveyed by specially painted sticks or beans painted in various colour combinations which had specific meanings. The Incas resorted to these devices since they had no written language.

CONTINUED ON NEXT PAGE

This postal service was so efficient that it covered the 3,000 odd miles of the Great Royal Highway in a matter of 20 days or so—four times faster than the "pony express" service introduced by the Spaniards after the Conquest. In the best season of the year, the *Chasquis* covered the distance between Cuzco and Quito in five days—a feat they continued to perform clandestinely during the Colonial era to the amazement of the Spaniards who dubbed this fleet-footed news-transmission system "post office of the sorcerers."

The astounding network of Andean roads and highways was the achievement of three Inca emperors: Pachacútec, Túpac Yupanqui and Huayna Cápac, the manpower for the construction work coming from the tribes of peoples they subdued.

Pachacútec, know as the "Reformer," was particularly fond of stone and for the Royal Highway he had enormous blocks of stone tranported hundreds of miles, particularly from the Kingdom of Quito, using the Indians of that region and a tribe called the Chancas.

The treatment meted out by the imperial guards (they were called Big-Ears) was such that the Indians finally revolted and almost overthrew the Inca kingdom. The earliest chroniclers relate how the huge stones (some weighing 10 tons) were carried such great distances and tell a story of how one such block fell and crushed a thousand Indians to death. It passed into legend as "the stone that wept blood."

Fifty years after the Conquest, a Spanish missionary, José de Acosta, visited the New World and noted that the Indians who worked on the roads " used no mortar, had neither iron nor steel for cutting and working the stones, no machines or instruments for transporting them, yet so skilful was their work that the joints between the stones were barely noticeable."

Túpac Yupanqui was the son of Pachacútec and carried on his father's work. He extended the Royal Highway as far as Chile in the south and beyond Quito in the north, thus opening up new territories for trade and development. To consolidate the empire he built a chain of fortresses near the Great Highway, and instituted a system of "population transfers," shifting newly conquered tribes to Peru and replacing them by loyal subjects.

Huayna Cápac, his successor, surpassed his father in the field of public works. He built Temples of the Sun and Inca Watchtowers along the Royal Highway. He repaired the old roads and built new ones, and had platforms and terraces made to prevent erosion of the soil.

But above all, Huayna Cápac was responsible for the repair, strengthening and consolidation of the suspension bridges. These bridges are one of the greatest feats of the Inca road network. They appear frail and delicate but proved astonishingly resistant. Flung across raging torrents and formidable mountain chasms, they were made of six-inch fibre and bamboo cables anchored into stone piers, and were covered with a floor of wooden laths solidly lashed together to resist the wind and other ravages of the elements.

Alexander von Humboldt was one of the many explorers who gazed in awe and amazement at the Inca suspension bridges. His description of one of them—the Bridge of San Luis Rey—was the source of inspiration for novels by Thornton Wilder and Prosper Mérimée. Humboldt considered the whole Inca road system far superior to that built by the Romans in Italy, France and Spain, and pronounced them "the most stupendous and useful works ever executed by man."

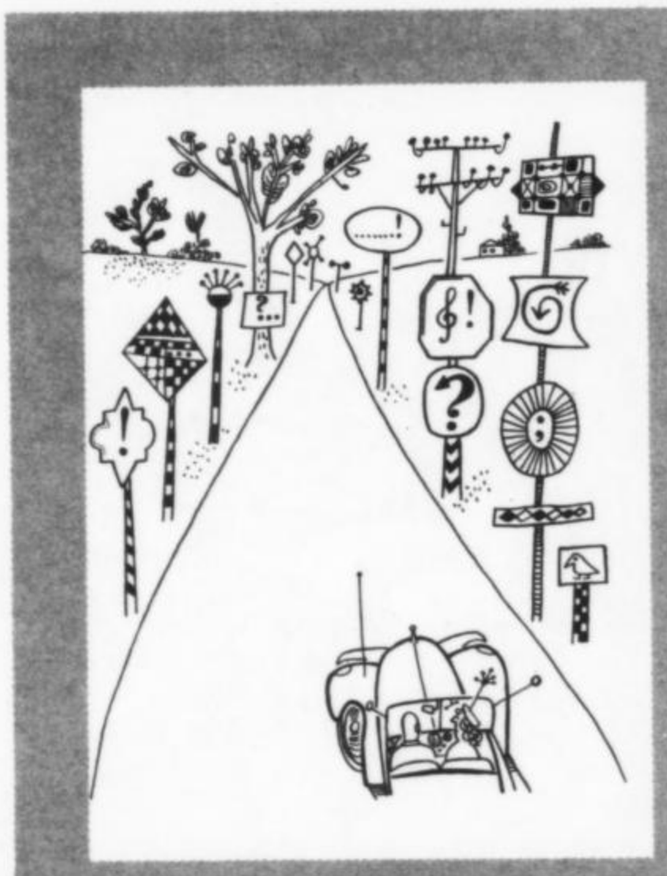
But the Incas' passion for roads went much further than building and engineering. They also set up a smooth running system of road maintenance. A "Royal Commissioner of Inca Roads and Bridges" supervised a staff of road inspectors whose duty it was to tour the realm and check on road conditions and on the toll-gate keepers controlling the heavy traffic of llama trains laden with produce.

Large crews of *yanakonas* were always on hand to sweep and clean the paved highways with brooms made of vegetable fibre. Yvar Lissner did not exaggerate when he said (in his book *How Our Ancestors Lived)* that at the time when the roads of Europe were no more than muddy, pot-holed ditches, the Incas had the finest highways anywhere in the world.

CAPTAIN Pedro Cieza de Leon, writing between 1533 and 1545, was the first European to give a detailed description of the Inca roads "which surpass those of the Romans as well as the road Hannibal built over the Alps."

As they penetrated the land of the Incas, the Conquistadores stared at the scene they saw with incredulous amazement: down the wide, spacious highway came groups of Indians carrying hammocks or litters containing personages of note. Other Indians drove trains of llamas laden with sacks of coca leaves or ears of corn. The very sight of these animals—half ewe, half ass—left the Spaniards open-mouthed.

It soon became clear to them why the roads were in such excellent condition: the only traffic on its paved surface consisted of sandal-shod pedestrians and gentle-footed llamas. Later, when the Conquistadores landed horses in the country (the Incas had never seen any before) their iron-shod hooves and the wheels of the heavy oxcarts were to cause havoc to the Llama Road and irreparably damage the Great Royal Highway of the Incas.



THE SIGNS OF STEINBERG

Photos United Nations

Their conquest completed, however, the Spaniards realized the advantages of the Inca road system and tried to preserve it by following the Indian example, at least in part. They adopted the llama caravans for carting off the gold they collected either as booty or tribute or which they extracted from the mines.

The Inca road system was thus not only an artery of blood but also of the gold of South America which went to raise the standard of life of Europe and to add splendour to the Renaissance.

The Royal Highway of the Incas, which cannot be dissociated from the llama, the postal network, the granaries and roadside inns, was in fact the direct instrument in the economic expansion of the Inca State (Inca society vested the entire wealth of the soil and sub-soil in the State and there was no private ownership of land).

As a result of the later neglect of the Spaniards, the inefficiency of Colonial organization, the ravages of time and above all, the excesses of the *encomenderos* (settlers) who used the Inca roads as a quarry for the stone they sought for their building, the whole highway network finally disintegrated. Nevertheless, traces of this unparalleled feat of engineering still remain today.

The Azuay region of Ecuador provides proof of the amazing solidity of the Inca Highway and of the skill with which the stones were fitted together. Despite the passing of centuries, and notwithstanding the continual, torrential rains prevalent in the area, water has not succeeded in filtering through the joints between the stones. Instead, the water has hollowed out a channel *beneath* the stones and flows away like a river under the arches of a bridge.

Further evidence of the Incas' skill, foresight and practical turn of mind is seen in their secondary roads which served as supply lines for the products vital to the kingdom. Thus Huayna Cápac built a road from Quito to the Coca valley in the eastern slopes of the Andes for the transport of the prized coca leaves; another road knifed throught the mountains to the coast and became the supply route for shrimp and other sea food.

This coastal road also supplied platinum, mined in the region, and salt extracted from the nearby island of Amortajada close to the coast of Ecuador. Another road, running laterally from Cuzco to the coast, made it possible to have fresh fish (considered one of the greatest delicacies) in the Inca capital within two days.

A striking example of the ingenuity and foresight of the Inca engineers is visible today near Macusani in the Carabaya gold country north-west of Lake Titicaca. In his book on the Inca roads, *Highway of the Sun,* Victor von Hagen describes how the Royal Road climbs to a dizzying height of 14,800 feet and then passes under a glacier.

"Here," he writes, "the engineers, anticipating the glacier's movement, had raised a retaining wall to catch the cascading rocks and to divert the snows high above the road. Here and there the eternal sweep and retreat of the glacier had sent rock crashing into and destroying a part of the road, but generally speaking it was in a good state of preservation."

Despite the passing of centuries and the inclemencies of nature, the general lines of the Royal Inca Highway can still be discerned and stretches of it are still intact. The suspension bridges in particular have withstood the assault of time and are to be seen in Ecuador, Peru and Bolivia where they are in use in districts where the wheel is still unknown even today.

— *June 1959*

DON QUIXOTE OF THE RADIO

Photo Unesco

Father José Salcedo's first broadcast in 1948 from his radio school in Colombia.

by Daniel Behrman

IN 1947, a slender young Catholic priest arrived in a forgotten hamlet perched high in the Andes of Colombia to take up his duties as assistant pastor of the Parish of Sutatenza. Father José Joaquin Salcedo brought to his first ministry a restless, driving urge to improve the lot of Colombia's *campesinos* who scrape their livelihood from incredible farms hugging dizzy mountain slopes. He also brought his amateur radio transmitter.

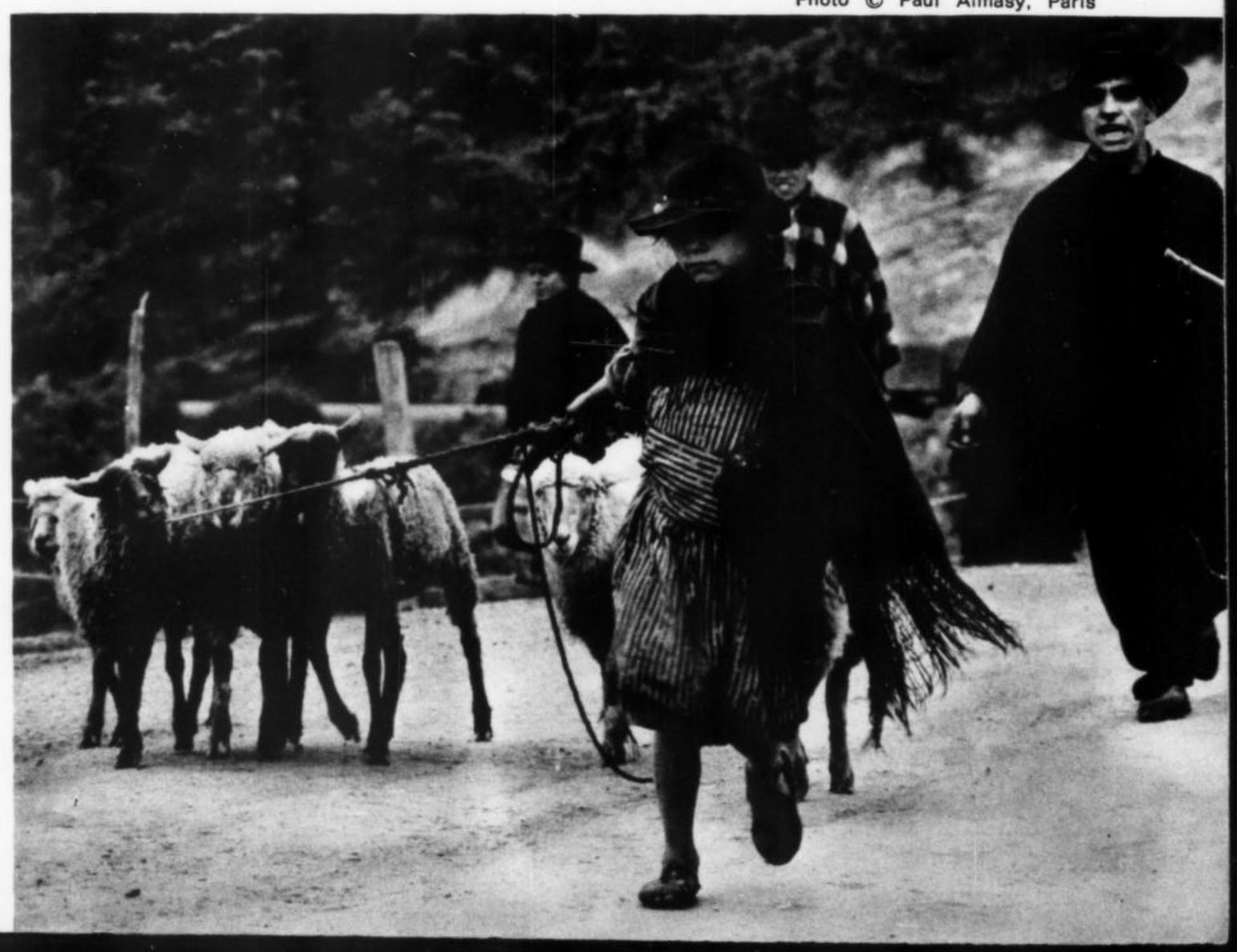
At that time the village consisted of eighty souls, but it was the largest community in a parish of 9,000 whose geography is typical of the Colombian Andes. Sutatenza Parish grows coffee in its warm valleys and raises sheep on its bald, chilly peaks. Some plots

CONTINUED ON NEXT PAGE

DANIEL BEHRMAN, *author and journalist, is now Unesco's science writer.*

Colombian farmers on their way to market. To bring education to the people of Colombia's impoverished mountain communities, Father José Salcedo started a radio school, which within a few years had become one of the world's most successful education-by-radio programmes, with over one million "pupils" in Colombia, Venezuela and Ecuador.

Photo © Paul Almasy, Paris



are so steep, local legend goes, that farmers seed them by shotgun.

Only one peasant in three could read or write. Alcoholism was common, and as often as not Saturday night in a *taberna* ended in a brawl with the principals finishing in the hospital. Father Salcedo believed there was no point in preaching sermons against the *tabernas;* instead, he decided to compete with them.

In August of 1947 on the village square of Sutatenza, he introduced the people of the village to the motion-picture screen. They thought they were in another world; long after the show ended, they huddled enchanted around the projector to stare respectfully.

Father Salcedo had gained a foothold. To consolidate it, he drew up plans for a permanent theatre. The village of Sutatenza offered its help, but it was not enough and there was no way of making a general appeal to the parish for volunteer masons and carpenters... not until Father Salcedo, who had built his first radio at the age of 13, turned to his amateur transmitter.

In May of 1948, Radio Sutatenza made its first broadcast, which was picked up by only three receivers. The priest asked *campesinos* to help him build the Sutatenza theatre and promised to record the voice of every man who aided him. Soon he was broadcasting the *campesinos'* own voices back to their amazed families and sixty men a day were coming to Sutatenza to work on the theatre, bringing materials with them—and money when they could.

WITH the theatre finished, Father Salcedo sought the help of the *campesinos* in developing what was to become the radio school. One day, the radio announced that farmers could make their contributions in chickens. Father Salcedo received more than 800 and had to hire a truck to haul them to market in Bogota. Money was also forthcoming, and by 1949, he was able to buy a 250-watt transmitter. There were enough radios for fifteen schools and the priest started broadcasting an educational programme once a week.

Seven years later Father Salcedo's home-made transmitter had been transformed into Accion Cultural Popular, one of the world's biggest programmes of adult education by radio.

Accion Cultural Popular broadcasts its lessons six hours a day to 200,000 pupils scattered over twelve of Colombia's sixteen departments and overflowing into neighbouring Venezuela and Ecuador. The radio schools are served by 6,000 specially built receivers and 10,000 more are on the way. Attendance at these remarkable schools is expected to rise to 1,000,000.

The programmes still go on the air from Sutatenza, but they are now carried by a 25-kilowatt transmitter, the most powerful in all Colombia. The Colombian Government backs Accion Cultural Popular to the amount of $800,000 a year and Unesco participated through the United Nations technical assistance programme.

Besides the studios and the transmitter in the transformed village of Sutatenza, Accion Cultural Popular now occupies most of the seventh floor of the biggest office building in Bogota. From an office with a panoramic view of the mountains of Guadelupe and Monserrate, Father Salcedo (1) continues to direct its work.

I asked Father Salcedo how he could explain the phenomenal growth of Accion Cultural Popular in so short a time. "Any work which meets a basic need of the people must grow in direct proportion to this need," he replied. "Here, it is the need of 7,000,000 people in a country of 12,000,000 for literacy and general culture. It is not surprising that the number of pupils in the radio schools has risen to 200,000."

"Some men in education have had reserves about our methods," Father Salcedo explained, "but they have now come over to our side because we are introducing scientifically-tested materials in the radio school. It is exactly for this reason that we requested technical assistance from Unesco—to make our teaching methods more scientific."

The receiving sets used in the radio schoolrooms are marvels of simplicity —battery-powered short-wave receivers manufactured specially for Accion Cultural Popular. They can be tuned to only one station, Radio Sutatenza, a precaution taken to preserve the life of their batteries. Still on the theory that culture should not be given away for nothing, Accion Cultural Popular sells a set and its batteries to a radio school at cost price. Each school, however, receives a free supply of chalk, an eraser, textbooks and an alarm clock—so that pupils will know when to turn on their set.

These little sets put in a hard day's work in the radio schools, most of them nothing more than rooms set aside in adobe homes. The house of the most educated *campesino* in a hamlet is always chosen for this honour, and its owner is given the title of *auxiliar inmediato.* It is this "immediate auxiliary" who takes attendance, turns on the radio when school begins, and writes lessons on the blackboard according to instructions given him by the unseen radio teacher.

He is one of the key men in Accion Cultural Popular, this remote-controlled teacher. The auxiliaries are always the farmers with the most modern ideas in their communities, and the distinction of leading the radio schools lends them even greater influence as forces for bettering the villages.

Programmes begin at ten minutes to six in the morning, the only time that most men can spare from their fields. Depending on the day of the week, the morning programme of one hour and twenty-five minutes consists of classes in reading and writing, hygiene, history, religious instruction or civics, always followed by a news broadcast. This programme is recorded on tape and repeated at 3.50 p.m. for women and again at 5 p.m. for any men who might have missed the morning class.

In the evening, Radio Sutatenza is on the air from 6.15 p.m. to 9 p.m., but school is over. Then it offers music—both classical and popular—news, variety shows, religious talks and a half-hour's drama on the theme of history, science, travel in Colombia or problems affecting farmers.

The *campesinos* learn to write and they write letters to Accion Cultural Popular. The letters pour in at the rate of 150 a day and they are a useful key to the popularity of various programmes. They also show how deeply the radio school has penetrated the inaccessible world of the *campesino.*

They write about everything. Some thank the school for taking them out of their solitude or for weaning husbands away from *tabernas.* And some ask practical, down-to-earth questions: what's good for a bad grippe, how do you cure a lame horse, how should a common-law couple go about marrying, what can be done about a disobedient daughter, how can children be educated if there is no school available, how does a wife get money out of a stingy husband. Every letter receives a reply, although Accion Cultural Popular does not pretend to have a solution to every question.

THERE are only 90-odd miles separating the Tenza Valley from what was once the almost-deserted village of Belencito in the north of Boyaca. In those 90 miles, you pass from an oxcart agricultural economy to one of the newest steel mills in Latin America. At Belencito, in the surrealistic shadows of coke ovens, conveyor belts and a 270-foot high blast furnace, Accion Cultural Popular began another experiment in radio education.

The conversion of the *campesinos* of Belencito into steel workers is a dramatic story. The men learned to make the transition from the hoe to the rolling mill, while their wives adapted themselves to an entirely new sort of life—that of an ordinary modern community.

(1) Now Monsignor Salcedo — *Editor.*

CONTINUED ON PAGE 76

THE FOUR FLOWERS OF TURKISH ART

The art of the book reached an extraordinary degree of development in Turkey during the 15th and 16th centuries, with the beauty of the calligraphy equalling that of the illuminations. One theme is always found in these works—that of the "four flowers"—the hyacinth, carnation, tulip and briar rose. The flower of flowers was the tulip, considered to be sacred since the Arabic letters used to write it in Turkish also spell the word God. In a society whose religious scruples forbade portraits on walls, Turkish artists confined their portraiture to the pages of albums and poetic works. A remarkable school of miniaturists produced this famous portrait of the Sultan Mohammed II, patron of the arts, inhaling the perfume of a rose.

— March 1953

PEKING MAN IN THE APOTHECARY'S SHOP

by G. H. R. von Koenigswald

NEANDERTHAL MAN is the only fossil man of whom we have a complete skeleton. In the case of all older discoveries we have only isolated remains—mostly of the victims of accidents. Thus we find human bones in limestones, and buried in sandstones, gravels and rock fissures.

We also find them in medicine shops and these "paleontological treasure houses" are certainly the most remarkable of all. I am, of course, not talking about just any apothecary shops, but about Chinese ones where almost anything which the vegetable, animal and mineral kingdoms of China have to offer can be bought.

Such remains are used as ingredients for medicine and, among various other medicaments, "dragons' teeth" are highly prized. These are not, as their name might suggest, the teeth of saurians and other large reptiles, but the fossilized remains of extinct mammals. It is already over a century since specimens of this kind gave us our first insight into the fossil mammals of China and they have since proved to be important links in the research chain leading us back to fossilized man.

G.H.R. VON KOENIGSWALD, *of the Federal Republic of Germany, has done extensive research in Indonesia and South China, where he made important finds concerning Peking Man. He is professor of paleontology at the University of Utrecht, Netherlands.*

When I was working as a geologist in Java, we became very interested in "dragons' teeth". Did they, we wondered, come from Java or from China? We soon found that they all came from China, but when we went into the question more closely we found that in ancient China there were once animals which are still living in Indonesia. The most surprising example was the orang-outang, the large anthropoid ape, which still inhabits Borneo and northern Sumatra.

To be absolutely sure that these remains came from China, a visit was made to Hong Kong in 1935, and the large apothecary shops in the "Western Market" were thoroughly combed. The result was astounding. The harvest included teeth of orang-outangs, tapirs, the Malayan bear, Panda (the friendly Bamboo bears), of deers, pigs, tigers and many other animals. But not one single jaw could we find. Large porcupines had gnawed away all the bones and teeth roots and only the crowns of teeth remained. It was clear that all this material must actually have come from southern China.

The largest of all the ape teeth found had a smooth surface instead of the fine wrinkles found on an orang-outang's teeth. I immediately felt sure that we had come across a new type of ape of enormous size. Subsequently, in 1935, on the basis of this single find I described Gigantopithecus, the giant ape of the Chinese apothecary shops.

Some of my colleagues disagreed, declaring that the tooth was much too large for an ape, and one of them, Professor Weidenreich, at first maintained that it was simply that of a very large orang-outang. I made further journeys to China, and in Canton I found a magnificent upper molar, and in another apothecary shop in Hong Kong an unworn lower molar. In certain respects both these teeth show much resemblance to the teeth of man, and Weidenreich, who had been so sceptical at first, completely changed his opinion, saying that he now considered my Gigantopithecus to have been a huge man. One German anthropologist even wanted to change the name to Giganthropus (anthropus—man; pithecus—ape), and even made a fantastic reconstruction of the jaw bone.

Finally, 22 years after the discovery of the original tooth, we were able to reach a more positive conclusion. On February 17, 1957, my old friend and colleague, Dr. Pei Wen Chung, exhibited in Peking an enormous jaw which had been found in a cave in Kwangsi, in southern China. It was a lower jaw with a somewhat less specialized anterior dentition than that of the living anthropoid apes. But it was an ape: the tooth found in the Hong Kong chemist's shop had not lied.

DON QUIXOTE OF THE RADIO *(Continued from page 74)*

To pave the way for this adaptation, the aid of Accion Cultural Popular was enlisted, and it assigned to Belencito its former programme director, Father Alejandro Rodriguez, the first collaborator of Father Salcedo in the radio schools of Sutatenza.

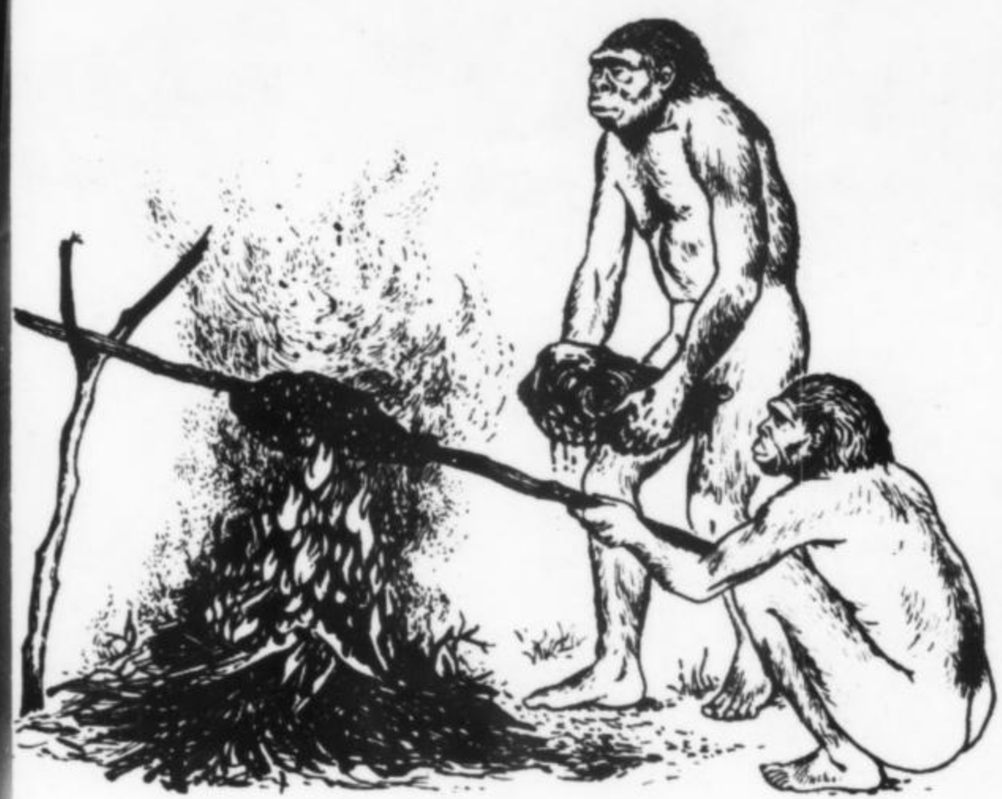
Father Rodriguez first went on the air in 1949. In 1951, he received a Unesco international fellowship to enable him to study the use of the radio in adult education in Canada.

Following his stay in Canada, Father Rodriguez travelled to Spain, France and England, concentrating on the organization of broadcasting and on its technical side. Then he went back to his microphone in Sutatenza until early in 1954 when he left to direct Radio Belencito. He started on a modest scale in the new mill town with a 1-kilowatt long-wave transmitter. Radio Belencito fits into a new network of long-wave transmitters established by Accion Cultural Popular at widely scattered points in Colombia.

Although Radio Belencito retransmits certain basic programmes of Radio Sutatenza, its objectives are not quite the same. In Belencito, Father Rodriguez uses the radio to help mould a colony of *campesinos*-turned-steel workers into a living community. Besides its classes, Radio Belencito broadcasts programmes for neighbourhood centres in the steel town. The radio serves the community as theatre, orchestra and forum and, to supplement it, spare time teachers were trained as neighbourhood leaders—the urban version of the *auxiliar inmediato*.

"Fifty per cent of our workers are illiterate," an official of the Belencito steel mill told me. "They learn quickly and their mechanical aptitude is high, but we want them to understand what they are doing and why they are doing it. This is extremely important to them—and to us. The Colombian economy needs this steel mill and we want our workers to be integrated into this new aspect of our economy."

— *February 1955*



Peking Man, a reconstruction based on remains found in the Choukoutien caves near Peking. He was capable of chipping rough tools and maintaining fires for warmth and protection, and his brain was as large as that of modern man. (See the Unesco-sponsored "History of Mankind, Cultural and Scientific Development"; Volume I: Part 1. "Prehistory and the Beginnings of Civilization" by Jacquetta Hawkes; G. Allen and Unwin Ltd., London).

After Le Gros Clark

The Kwangsi jaw is larger than that of a gorilla, which means that Gigantopithecus itself was larger than this ape, the largest and most powerful of anthropoid apes living today. My Chinese colleagues estimated that it must have been at least three metres tall. I am still getting letters from people asking whether Gigantopithecus might not have been the "abominable snowman" from the Himalayas, and people are very disappointed when I have to tell them that I do not think so.

Another discovery was made which, although perhaps not so dramatic, was no less fruitful. In 1900 a German engineer named Haberer brought back a large collection of "dragons' teeth" to Germany and our first extensive knowledge of the fossil mammals of China is based on the description of these specimens. The most remarkable item was a human tooth, extremely worn and apparently very old. It too had come from an apothecary shop in Peking, and the search for the fossilized remains of human beings was therefore concentrated on this area.

THIS led to a now celebrated event: the discovery of the Peking Man (Sinanthropus) of which, in the first place, a single tooth had been unearthed. This was claimed by Professor Davidson Black to be a hitherto unknown fossil man. A skull found in 1929 by Dr. Pei, proved that Black was right. Successful excavations are still being made on the same site.

The teeth of the Peking Man are very large and similar to some of those found among our apothecary shop specimens from Hong Kong. There were also smaller teeth and because of the red clay which was found on one part of the jaw, Father Teilhard de Chardin (whose name is also linked with the discovery of the Peking Man) identified it as coming from a Late Stone Age horizon which is often to be found in caves. This was the jaw of a "modern" man, only a few thousand years old. One of the teeth is so similar to the first tooth found in the Peking apothecary shop that both must have come from the same strata. It was, therefore, a modern tooth which put us on the track of Peking Man!

The discovery of the Peking Man brought the solution to an earlier problem: whether the remarkable flat skull cap dug up in Java by E. Dubois in 1890 was that of a man or an ape. In 1891 an indisputably human thigh bone was added to the earlier find though there was no direct proof that both discoveries belonged to the same subject. Dubois combined the two and his "erect walking Java Ape-Man", the Pithecanthropus erectus, remained the most controversial fossil for nearly 40 years.

The main reason for this was that the ear region of the Java skull was missing and it is precisely this part of the skull which makes it possible to reach a clear decision. In the case of the Peking Man a complete skull was available and in spite of his primitive characteristics he was, anatomically speaking, indisputably human. This is also shown by the simple stone implements and the layer of ashes found at the place of discovery, which makes it clear that he already knew about tools and fire.

The shape of the Peking skull was so similar to that of the controversial Java find that Black concluded that the Peking Man and the Java Man must have been close relatives. The remarkable thing was that Dubois, the discoverer of Pithecanthropus, disagreed with this theory. Although he had always previously defended the human characteristics of his find, he now denied that it was related in any way to Peking Man and even went so far as to declare that his Pithecanthropus was an ape.

The only way to resolve such a confused situation was to redouble our efforts in searching for the Java Man. We found a promising site in central Java with exposed strata in which there were many remains of the same extinct deer, antelopes and elephants as those discovered by Dubois in association with his Pithecanthropus.

FOR years we worked in this area. During the rainy season the downpour of water scattered the loosened fossils over the hillsides and we eagerly went to work, soon assembling a large collection of teeth and bones of extinct animals. This included the remains of hippopotamuses—no longer found in Asia—various elephants, deer, pigs, tigers, rhinoceros and other animals.

Then, one day in September 1937, we made an important find. One of my enthusiastic Indonesian collectors came across a piece of skull. The next day I hastened to the spot and promised the workers ten cents for every piece of skull they brought me. I myself soon found a large piece of the frontal bone, but my collectors only brought me small fragments.

Too late I discovered what had happened; the workers had broken up all the larger pieces in order to make more money! I was eventually given more than 40 pieces, but fortunately there was very little difficulty about joining them together since the skull was over one centimetre thick.

It soon became clear that we had actually found a second Pithecanthropus skull. It would be difficult to find two skulls in a modern anthropological collection which are so completely alike as Pithecanthropus I and II, although the places of discovery were 30 miles apart. The new find was finally complete enough to include the ear regions on both sides of the skull. One glance was enough: Pithecanthropus had undoubtedly been a human being. After 46 years the puzzle had finally been solved.

— July-August 1961

THE NEW SCIENCE OF ART CONSERVATION

(*Continued from page 57*)

Photos © A.C.L., Brussels

THE SAME STATUE BEFORE AND AFTER RESTORATION. Left, ravaged features of a 16th century painted stone statue of the Virgin, from St. John's Hospital, Bruges, Belgium. Cracks and wrinkles have rendered the work almost unrecognizable. Right, statue after it had undergone cleaning and restoration.

doorway. But this is not the end. The monument will be destroyed unless humidities are maintained, at least until the mural paintings can be removed and conditioned to the drier environment above ground.

We have learnt much from our wartime experience of fire and pestilence and, not least, that the slow decay of susceptible material by exposure to damp can be quite as destructive as the damage from high explosives.

A picture may disappear from a wall eaten up by mould growths, leaving only a nondescript stain. But even here science may have the last word. I know of paper bearing invisible drawings having been nursed into shape and successfully doctored by chemicals so that the drawings were actually brought back to life again.

Things that are invisible to the naked eye can be photographically recorded by using the methods of ultra-violet fluorescence, and in every police laboratory there are several methods by which it may be possible to recover and decipher on charred or burnt documents writings or drawings when the ink seems to have been completely burnt away.

The Italians are past masters at what might be called preservation medicine and surgery. This is born of a natural facility in the studio and laboratory and the untold wealth of their cultural heritage which demands incessant attention. For it is not true that a monument having survived from antiquity, will necessarily go on surviving. Nature is always in a condition of change and the change may be either sudden, through excavation, or slow, through neglect.

First come the rains, then growths appear of moss, lichens or algae, and the mortar is loosened. Ivy grows over the ruin, attacks the structure with its penetrating suckers. Humus is formed, plants root themselves, the level of the surrounding earth rises and capillary moisture weakens the foundations so that the building becomes derelict, and in this condition it is liable to be used as a source of stone for building or agriculture.

How different is the picture when the aids of science are involved. The modern architect and chemist knows how to exclude moisture, prevent or destroy damaging organic growths without contaminating the stone, introduce a hidden armature of ferro-concrete, grout walls with an approved cement.

And, if the foundations are unsatisfactory or unstable hydrologically, there are simple means by which consolidation is possible using the methods of electro-osmosis as applied, for example, in Warsaw by Cebertowicz to prevent the Church of St. Anna from destruction due to the movement of the clay slope on which it rested. The clay was consolidated, the movement was arrested and a rock-like basis for the structure provided by the electro-deposition of calcium silicate.

GREAT advances have been made in methods of conditioning the air of museums and galleries to give constant figures of temperature and relative humidity and to remove dust and noxious contaminents.

At least one war-time repository was constructed in an underground mine where, beforehand, the dew-point had been continuously exceeded and mushrooms were farmed commercially! Control methods were put into operation with the result that this mine, though far below the surface of the ground, became the perfect store room for the most sensitive materials—archives, textiles, books and even salt-laden Egyptian stele and other monuments: no single object suffered damage.

But major problems remain. How can one hope to deal with a monument carved in crumbling laterite exposed in a monsoon climate to alternatives of fierce heat and torrential rains? We do not know, but we can do some calculated guess-work which, in the scientific field, is often the precursor of the pilot-experiment that leads to an eventual solution.

Not long ago waterlogged wood was considered to be practically beyond redemption. Now, the position is much brighter, thanks to a concerted attack by museum scientists working in several countries, e.g. in Poland, at the pre-Slav village of Biskopin which is gradually being recovered from its watery grave, on iron-age settlements in Switzerland and on the frail but interesting timbers from mines and from wells in the United Kingdom.

Each country has something to contribute. National museums take pride in the quality of their conservation work and friendly exchange of information in all such matters takes place.

The conservation of monuments is of world importance, so much so, that an intergovernmental organization exists for the study of the preservation and restoration of cultural property, the so-called "Rome Centre" and this serves all nations with up-to-date information regarding methods and equipment and materials and helps to train young curators and museum technicians.

Its activities are known in many countries throughout the world. It has worked in collaboration with Unesco for the protection of the Buddhist temples of South Korea from destruction and staining by water and lichen growths, etc., and on Pakistan's Mohenjo Daro, being seriously damaged by salt crystallizations.

It has also worked on Indian cave paintings darkened by shellac, on the painted tholos of Kasanluk in Bulgaria, whose colours were flaking off in layers, and on the Mayan site of Bonampak in Mexico, where wonderful frescoes have miraculously survived in the heart of the rain forests.

Work has also been done in Morocco, Tunisia, Libya, Egypt and on many Middle East sites, and on medieval gold crosses in Vienna. Biblical scrolls have been studied, dissected and made available to scholars.

Patiently, continuously, this labour of conservation goes on, a constructive service to preserve for posterity the monuments of the past that have served through the ages as a solace and an inspiration to mankind and will do so in generations to come.

— *January 1965*

Stones also die

EVERY country has become increasingly aware of the grave deterioration of the world's architectural legacy. Buildings and statues which stood the test of time have been seriously damaged in recent years by air pollution. The million tons of coal burnt every year in Greater Brussels alone discharges about 20,000 tons of sulphur dioxide into the air. The sulphur dioxide dissolved in fog, rain and snow turns into sulphuric acid, the corrosive power of which is well known. The fumes released by automobiles is an even more serious problem, the sulphur dioxide produced being even greater than that from coal. In Los Angeles the 50,000 tons of petroleum products consumed each day, a few years ago, discharged 400 tons of sulphur dioxide into the air. The pollution of the atmosphere of our cities and industrial centres is thus the chief cause of the weathering and deterioration of public buildings and monuments. On the calcareous stones of buildings a crust forms, and the stone develops blisters or cankers, and cracks; then the crust scales off, exposing to the elements a powdery surface which is easily eroded by rain and wind. This "disease" of stone, like an insidious form of leprosy, is nowadays attacking monuments and damaging them at an alarming rate.

— *January 1965*

RENE SNEYERS

Institut Royal du Patrimoine Artistique, Brussels

The admirable 12th century doorway of the Cathedral of Santiago de Compostela, Spain, is one of the master works from the past that have been spared the depredations of man and the elements.

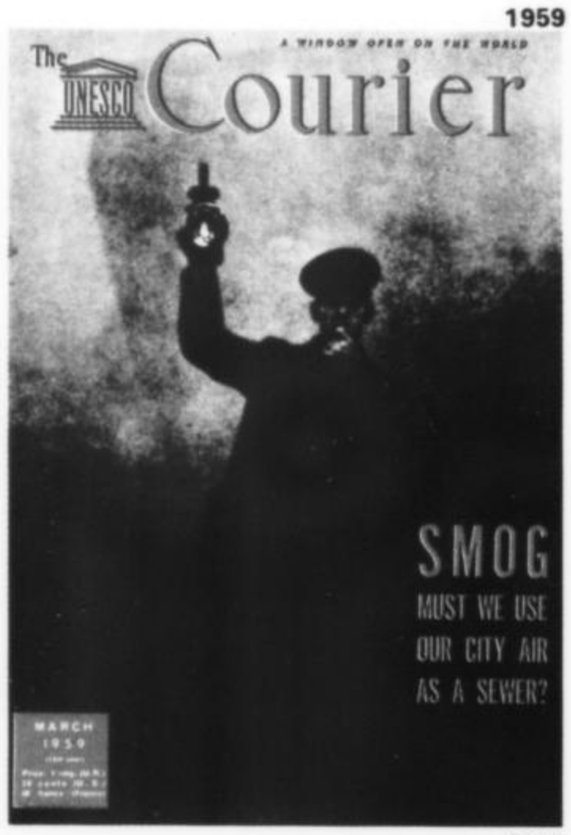
Photo René Caloz

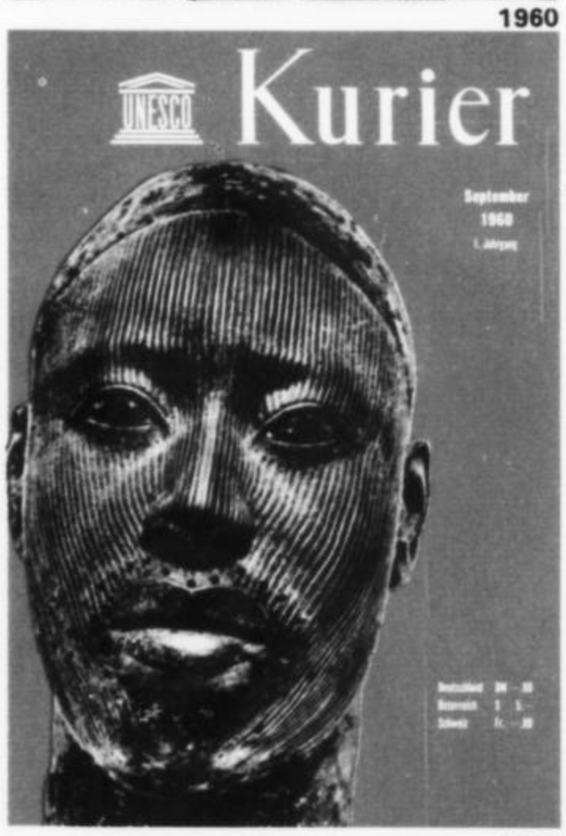
1958

1959

1960

1961





1962

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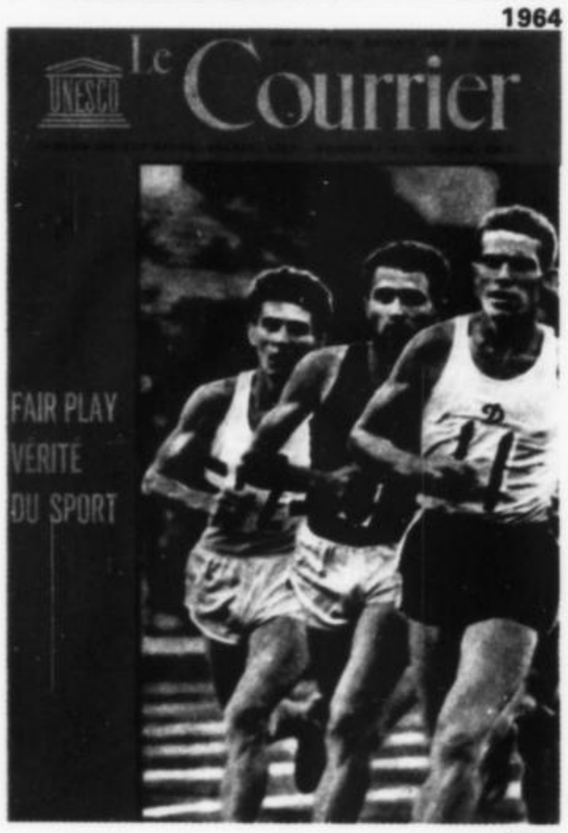

1966

1967

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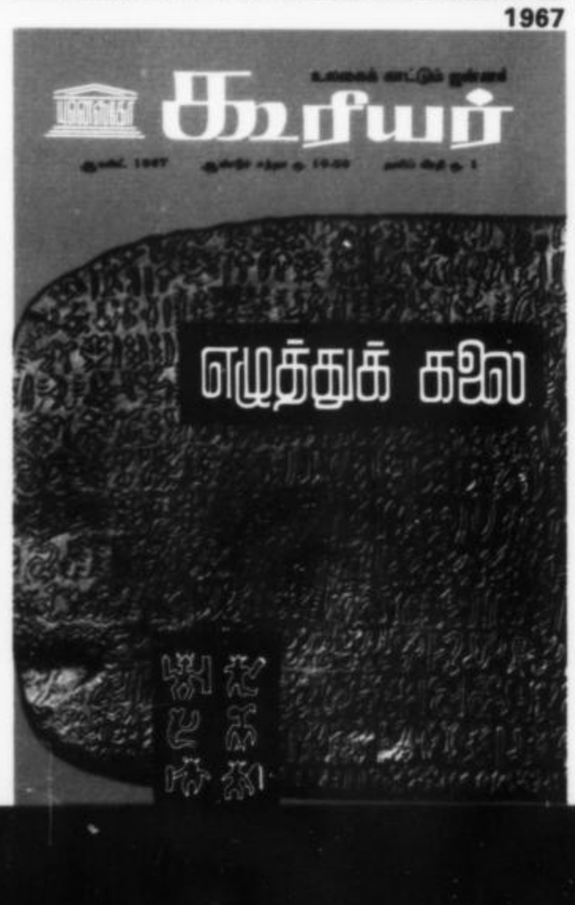
1968